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PROGRAM AND ABSTRACTS OF THE TWENTY-THIRD ANNUAL MEETING OF THE AMERICAN SOCIETY OF PARASITOLOGISTS

NEW ORLEANS, LOUISIANA

December 5, 6, 7, and 8, 1948

PROGRAM[1]

MONDAY MORNING SESSION, DECEMBER 6, 9:00 AM, ROOSEVELT HOTEL, UNIVERSITY ROOM.

Read

1. Comparative Studies on Cultivation and Antibiotic Treatment of the Human Intestinal Amoebae. (15 min) (Lantern) WILLIAM BALAMUTH, Northwestern University.

2. Oxidation-Reduction Potentials of *Entamoeba histolytica* in an Essentially Synthetic Medium. (15 min) (Lantern) JOHN L. BRADIN, JR. AND EDER L. HANSEN, University of California.

3. A Biochemical Approach to the Problem of Cultivating *Endamoeba histolytica* Without Bacteria. (15 min) (Lantern) CHAS. W. REES, LUCY V. REARDON, AND HARRY D. BAERNSTEIN, National Institutes of Health, with the collaboration of LESLIE HELLERMAN, Johns Hopkins University.

4. Lipoidal Extract Cultivation Medium. (10 min) E. CLIFFORD NELSON, Medical College of Virginia.

5. Axenic Cultures of *Neoaplectana glaseri* Steiner in Fluid Media. (15 min) (Lantern) NORMAN R. STOLL, Rockefeller Institute for Medical Research, Princeton, New Jersey.

6. P.V.A.-Fixative as a Preservative and Adhesive Solution for Staining Protozoa in Dysenteric Stool and Other Liquid Materials. (15 min) (Lantern) M. M. BROOKE AND MORRIS GOLDMAN, Communicable Disease Center, U.S. Public Health Service, Atlanta, Georgia.

7. Changes of *E. histolytica*. (10 min) (Lantern) VIOLA MAE YOUNG, Hektoen Institute for Medical Research, Cook County Hospital, Chicago, Illinois.

8. Chemotherapy of *Tritrichomonas foetus* Infections in Rabbits. (15 min) BANNER BILL MORGAN, University of Wisconsin.

9. Glucose Consumption of *Plasmodium gallinaceum in vitro*. (10 min) (Lantern) REGINALD D. MANWELL AND PHILIP FEIGELSON, Syracuse University.

[1] An alphabetical author index will be found at the end of the program. Extra copies of this Supplement, and portraits of parasitologists, will be on sale at the meeting.

10. Virulent Plasma in Malaria by *Plasmodium gallinaceum* Brumpt 1935. (10 min) JUAN BACIGALUPO, University of Buenos Aires.

11. Effect of Worm Parasites on the Growth of and Feed Utilization by Pigs. (10 min) (Lantern) JOHN S. ANDREWS AND D. J. JONES, U.S. Bureau of Animal Industry.

12. The Destruction of Horse Strongyle Larvae by Chemicals. (10 min) NORMAN D. LEVINE, University of Illinois.

13. Phenothiazine as a Larvicide Against the Hookworm of Cattle. (15 min) (Chart space) ROY L. MAYHEW, Louisiana State University.

14. Ascarids a Cause of Loss to the Meat Industry through Condemnation of Swine Carcasses due to Icterus. (15 min) L. A. SPINDLER, U.S. Bureau of Animal Industry.

MONDAY AFTERNOON SESSION, DECEMBER 6, 2:00 PM, ROOSEVELT HOTEL, UNIVERSITY ROOM.

Read

15. Post-Cercarial Development of *Schistosoma mansoni* in the Rabbit and Hamster after Intraperitoneal and Percutaneous Infection. (15 min) (Lantern) TAMARTH K. YOLLES, DONALD V. MOORE, AND HENRY R. MELENEY, New York University.

16. The Number and Morphology of the Chromosomes of a Digenetic Trematode, *Rhopalias macracanthos* Chandler, 1932, from the Opossum. (10 min) (Lantern) HONORICO CIORDIA, University of Tennessee.

17. Phenyl Mercuric Compounds for the Removal of Tapeworms from Poultry. (15 min) (Lantern) JAMES E. GUTHRIE AND PAUL D. HARWOOD, DR. HESS AND CLARK, INC., Ashland, Ohio.

18. *Pomatiopsis lapidaria* (Say), an American Intermediate Host for *Schistosoma japonicum.* (15 min) (Lantern) ELMER G. BERRY AND RUTH ELIZABETH RUE, National Institutes of Health.

19. A Study on the Comparative Susceptibility of Snail Vectors to Strains of *Schistosoma mansoni.* (15 min) (Lantern) (Chart space) VIRGINIA S. FILES AND ELOISE B. CRAM, National Institutes of Health.

20. Germinal Material in Rediae of Two Species of Trematodes from *Pomatiopsis lapidaria.* (10 min) (Lantern) D. J. AMEEL, Kansas State College; W. W. CORT, Johns Hopkins University; AND ANNE VAN DER WOUDE, University of Michigan.

21. Notes on *Diphyllobothrium stemmacephalum* Cobbold, 1858. (6 min) (Lantern) (Also by demonstration) HORACE W. STUNKARD, New York University.

22. Speciation in the Cestoda. (12 min) (Lantern) ARTHUR W. JONES, University of Tennessee.

23. A Gregarine from the Sand-crab, *Emerita analoga.* (10 min) (Lantern) GORDON H. BALL, University of California at Los Angeles.

24. The Distribution of Pest Chiggers near Duke University. (15 min) (Lantern) G. W. WHARTON, Duke University.

25. The Incidence of *Leucocytozoon simondi* Mathis and Leger, 1910 Among Domestic Ducks in Northern Michigan. (10 min) ELI CHERNIN, Johns Hopkins University, AND ELVIO H. SADUN, University of Arkansas.

26. The Occurrence of *Hypoderma* Larvae in the Spinal Canal of Cattle (Diptera: Oestridae). (10 min) WARREN HABERMAN AND BANNER BILL MORGAN, University of Wisconsin.

27. Experiments on the Use of Quinoline Compounds for the Prevention of Blackhead in Turkeys. (10 min) (Lantern) NEAL F. MOREHOUSE, Dr. Salsbury's Laboratories, Charles City, Iowa.

28. Relation of the Gonadal Hormones to the Natural Resistance of Chickens and to the Growth of the Nematode, *Ascaridia galli*. (15 min) (Lantern) ELVIO H. SADUN, University of Arkansas.

29. The Effect of Some Nematode Infections on the Leucocyte Count in Sheep. (10 min) (Lantern) JOHN T. LUCKER AND ELEANOR M. NEUMAYER, U.S. Bureau of Animal Industry.

MONDAY EVENING, DECEMBER 6, 7:00 PM, ROOSEVELT HOTEL, ROOM H
Dinner and business meeting, officers and members of the Council.

TUESDAY MORNING SESSION, DECEMBER 7, 9:00 AM, ROOSEVELT HOTEL, GRAND BALL ROOM.

Joint Session

American Society of Parasitologists, American Society of Tropical Medicine, and National Malaria Society.

TUESDAY AFTERNOON SESSION, DECEMBER 7, 2:00 PM, ROOSEVELT HOTEL, UNIVERSITY ROOM.

Panel Discussion

Arthropod Vectors of Human Disease

Mite-Borne Diseases (25 min)

30. Parasitic Mites Other than Chiggers as Vectors of Human Diseases. CORNELIUS B. PHILIP, Rocky Mountain Laboratory, U.S. Public Health Service.

31. Trombiculid Mites in Relation to Human Diseases. HENRY S. FULLER, Harvard University.

Tick-Borne Diseases (25 min)

32. Argasid or Soft Ticks in Relation to Disease Agents of Man. GORDON E. DAVIS, Rocky Mountain Laboratory, U.S. Public Health Service.

33. Maladies of Man Carried by Ixodid or Hard Ticks. CORNELIUS B. PHILIP, Rocky Mountain Laboratory, U.S. Public Health Service.

Bug-Borne Diseases (15 min)

34. Human Diseases Transmitted by Parasitic Bugs. E. DIAS, Instituto Oswaldo Cruz, Rio de Janeiro, Brazil.

Louse-Borne Diseases (15 min)

35. Lice as Vectors of Human Diseases. JOHN C. SNYDER, Harvard University, AND CHARLES M. WHEELER, Public Health and Welfare Section, Supreme Commander of the Allied Powers in the Pacific.

Flea-Borne Diseases (15 min)

36. Fleas as Vectors of Human Diseases. C. R. ESKEY AND FRANK M. PRINCE, Plague Suppressives Laboratory, U.S. Public Health Service.

Fly-Borne Diseases (50 min)

37. Anopheline Mosquitoes in Relation to Human Diseases. L. E. Rozeboom, Johns Hopkins University.

38. Culicine Mosquitoes in Relation to Human Diseases. William C. Reeves, Hooper Institute, San Francisco, California.

39. Biting Flies Other than Mosquitoes as Carriers of Human Diseases. Daniel M. Jobbins, Rutgers University, and Marshall Hertig, World Health Organization, Athens, Greece.

40. Relationship of Non-Biting Flies to Human Diseases. James Watt, National Institutes of Health.

Tuesday Afternoon, December 7, 4:30 PM, Roosevelt Hotel

Organization meeting of the Parasitologists of the Mid-West.

Wednesday Morning Session, December 8, 9:00 AM, Roosevelt Hotel, University Room.

Read

41. Chemotherapy of Experimental Trypanosomiasis with Certain Bis (2-methyl-4-amino-6-quinolyl Amides and Ethers. (15 min) (Lantern) Frans C. Goble, Sterling-Winthrop Research Institute, Rensselaer, New York.

42. Influence of SH-inhibitors on the Oxygen Consumption of the Blood Stream Form of Some Trypanosomes. (15 min) (Lantern) Theodor von Brand and Eleanor Johnson Tobie, National Institutes of Health.

43. A Detailed Comparative Study of Cement Glands in Males of the Acanthocephala. (15 min) (Lantern) Harley J. Van Cleave, University of Illinois.

44. The Prognosis of Mal del Pinto (Pinta or Carate). (15 min) (Lantern, Opaque Projection, Motion Picture) (Also by demonstration) Eduardo Aguirre Pequeño, University of Nuevo León, Monterrey.

45. Infection Experiments with the Filarial Worms of the Cotton Rat. (15 min) (Lantern) Etta Mae Macdonald and J. Allen Scott, University of Texas.

46. Comparative Studies on the Anatomical Structures of the Third and Fourth Stage Larvae of the Filarial Worms of the Cotton Rat. (15 min) (Lantern) J. Allen Scott and Etta Mae Macdonald, University of Texas.

47. Humidity Requirements of *Ascaris lumbricoides* var. *suum* ova. (10 min) (Chart space) Aaron Seamster, Del Mar College.

48. Variation in Distribution of Wisconsin Fish Parasites. (15 min) Ralph V. Bangham, College of Wooster.

Wednesday Morning Session, December 8, 11:00 AM, Roosevelt Hotel, University Room.

Presidential Address

49. Reflections of a Medical Parasitologist. Ernest Carroll Faust, Tulane University.

Wednesday, December 8, La Louisiane Restaurant, 725 Rue Iberville.

12:30 PM, Parasitologists' Luncheon.

1:30 PM, Annual Business Meeting.

WEDNESDAY AFTERNOON SESSION, DECEMBER 8, 2:30 PM, 5TH FLOOR, HUTCHINSON CLINIC BUILDING, TULANE UNIVERSITY.

By Demonstration

21. Notes on *Diphyllobothrium stemmacephalum* Cobbold, 1858. (Also read) HORACE W. STUNKARD, New York University.

44. The Prognosis of Mal del Pinto (Pinta or Carate). (Also read) EDUARDO AGUIRRE PEQUEÑO, University of Nuevo León, Monterrey.

50. Chemotherapy of Experimental Amoebiasis in Rats and Mice. (Also read at joint session) ASHTON C. CUCKLER AND CHRISTINE MALANGA, Merck Institute for Therapeutic Research, Rahway, New Jersey.

51. Progress Report on a Study of Methods of Pinworm Diagnosis. PAUL C. BEAVER, Tulane University and Georgia Department of Public Health.

52. Metachromatic Determination of Mucoprotein Distribution in *Paragonimus kellicotti.* FRANCIS J. KRUIDENIER, University of Illinois.

53. Crystals in Opalinids. J. L. MOHR, University of Southern California.

54. Ultra-rapid Demonstration of Unicellular Blood Parasites in Minimum Concentrations by Thedane Blue Methods. H. C. R. SIMONS, National Research Council.

55. Studies on the Cestode Genus *Paruterina* (Cestoda: Dilepididae). R. RAUSCH, EVERETT L. SCHILLER, AND BANNER BILL MORGAN, University of Wisconsin.

56. Studies on Species of *Paranoplocephala* Parasitic in North American Rodents (Cestoda: Anoplocephalidae). R. RAUSCH, BANNER BILL MORGAN, AND EVERETT L. SCHILLER, University of Wisconsin.

57. Variation in *Andrya macrocephala* Douthitt, 1915 (Cestoda: Anoplocephalidae). R. RAUSCH, EVERETT L. SCHILLER, AND BANNER BILL MORGAN, University of Wisconsin.

58. *Apororhynchus* sp. (Apororhynchidae: Acanthocephala) from North American Birds. ELON E. BYRD AND J. FRED DENTON, University of Georgia.

59. Apparatus and Methods for Raising and Handling Tropical Rat Mites. J. ALLEN SCOTT, University of Texas.

60. Studies on a Haemogregarine from the Leopard Frog. JOHN K. BAILEY, University of Tennessee.

61. The Chromosomes of *Macracanthorhynchus hirudinaceus,* the Giant Thorny-headed Worm. HELEN L. WARD, University of Tennessee.

62. Susceptibility of Two Species of Louisiana *Tropicorbis* to *Schistosoma mansoni.* RUSSELL MICHAEL MCQUAY, JR., Tulane University.

63. Dicrocoeliid Trematodes of North American Birds. J. FRED DENTON AND ELON E. BYRD, University of Georgia.

64. An Improved Ruling for the Ocular Disc of Special Usefulness in Parasitology. EDWARD P. OFFUTT, University of Rochester.

65. Some New Concepts in the Embryology of Nematodes. ARTHUR E. WOODHEAD, University of Michigan.

66. Vaginal Sphincter, New Organ of *Echinococcus granulosus.* JUAN BACIGALUPO AND ENRIQUE RIVERO, University of Buenos Aires.

67. A Simplified Method of Displaying 2″ × 2″ Color Slides. LEONARD REID DAVIS AND DALE A. PORTER, U.S. Regional Animal Disease Research Laboratory, Auburn, Alabama.

106. Methylene Blue Precipitated with Cadmium Chloride as a Restaining Agent for Blood and Tissue Protozoa. ERNEST HARTMAN, Chicago Medical School.

By Title

68. Incidence of *Endamoeba histolytica* and Other Parasites of Man in Wisconsin. I. Preliminary Report on a Group of College Students. DAVID R. LINCICOME, WALTER H. THIEDE, AND ELIZABETH H. CARPENTER, University of Wisconsin.

69. Observations on the Life Cycle of *Neoechinorhynchus emydis,* an Acanthocephalan Parasite of Turtles. DAVID R. LINCICOME, University of Wisconsin.

70. Distribution of *Leptorhynchoides thecatus,* a Common Acanthocephalan Parasitic in Fishes. DAVID R. LINCICOME, University of Wisconsin.

71. Experimental Infections of Pigs with *Oesophagostomum dentatum* and *O. longicaudum.* DOYS A. SHORB, U.S. Bureau of Animal Industry.

72. Folliculinids Associated with *Limnoria* in California and Washington. J. L. MOHR AND J. A. LEVEQUE, University of Southern California.

73. The Cyclic Transmission of Japanese Encephalitis by *Culex quinquefasciatus,* Utilizing Young Albino Mice. HERBERT S. HURLBUT AND JOHN I. THOMAS, Naval Medical Research Institute.

74. Morphological Variations of Trophozoites of *Endamoeba histolytica* as Affected by Temperature and Cultivation and its Practical Bearing in Diagnosis. H. TSUCHIYA, Washington University.

75. The Diagnosis of Taeniasis by Perianal Swab. ALAN C. PIPKIN, American University, Beirut, Lebanon.

76. An Intensive Treatment Regimen of Vesical Schistosomiasis with Fuadin. JOSEPH E. AZAR, ALAN C. PIPKIN, AND G. A. GARABEDIAN, American University, Beirut, Lebanon.

77. Treatment of Taeniasis Saginata with Atabrine. ALAN C. PIPKIN AND EMILE RIZK, American University, Beirut, Lebanon.

78. Parasites of the Ranidae (Amphibia). XI. A. C. WALTON, Knox College.

79. Parasites of the Ranidae (Amphibia). XII. A. C. WALTON, Knox College.

80. Parasites of the Ranidae (Amphibia). XIII. A. C. WALTON, Knox College.

81. Comparative Fertility of Strongylid Eggs Passed by Horses. A. C. TODD AND M. F. HANSEN, Kentucky Agricultural Experiment Station.

82. *Eimeria tenella* Infection in Chickens with Induced Mild Hyperthyrosis. A. C. TODD AND M. F. HANSEN, Kentucky Agricultural Experiment Station.

83. Inter-generic Crosses Among Schistosomes (Trematoda: Schistosomatidae). ROBERT B. SHORT, University of Michigan.

84. Infective Uniparental Miracidia of *Schistosomatium douthitti* (Trematoda: Schistosomatidae). ROBERT B. SHORT, University of Michigan.

85. Preliminary Drug Trials to Determine Anthelmintic Activity Against *Trichocephalus vulpis* in Dogs. J. C. SWARTZWELDER AND H. E. WICKER, Louisiana State University.

86. The Effect of a Blacktongue Producing Diet on Experimental Amoebiasis in Dogs. JOHN E. LARSH, JR., University of North Carolina.

87. The Role of Certain Vitamins in Alcoholic Debilitation of Mice Infected with *Hymenolepis*. JOHN E. LARSH, JR., University of North Carolina.

88. Comparing the Immune Response of Young and Old Mice to Infections with 50 and 300 Larvae of *Trichinella spiralis*. JAMES R. HENDRICKS, University of North Carolina.

89. Tissue Phase of *Ascaridia galli* Life Cycle Elucidated by Artificial Digestion Apparatus. J. E. ACKERT AND R. L. TUGWELL, Kansas State College.

90. The Morphology of *Urceolaria karyolobia* sp. nov., *Trichodina tegula* sp. nov., and *Scyphidia ubiquita* sp. nov. from Southern California Limpets and Turbans. HENRY I. HIRSHFIELD, University of Missouri.

91. AEX and "Faust Simplificado" (Bonilla-Naar), Two New Methods for Investigating Intestinal Parasitism. ALFONSO BONILLA-NAAR AND MIGUEL GOMEZ-VARGAS, Facultad Nacional de Medicina, Bogota, Colombia.

92. Culture Experiments with *Heterodera marioni*. M. S. FERGUSON, Rockefeller Institute for Medical Research, Princeton, New Jersey.

93. *Moniezia expansa* Infections in Sheep. PHILIP A. HAWKINS, Michigan State College.

94. Seasonal Studies on *Oncomelania nosophora* and the Control of *Schistosoma japonicum* in Japan. DONALD B. MCMULLEN, 406th Medical General Laboratory.

95. Results of Screening Tests on Chemicals as Molluscicides. DONALD B. MCMULLEN, 406th Medical General Laboratory; N. ISHII AND Y. MITOMA, National Institute of Health, Japan.

96. Seasonal Studies of *Schistosoma japonicum* Infections in the Intermediate Host, *Oncomelania nosophora*. DONALD B. MCMULLEN, 406th Medical General Laboratory, with the technical assistance of T. ENDO, P. R. STONE, S. SETO AND M. KAMIYAMA.

97. Studies on Epidemic Amebiasis Occurring in Occupants of the Mantetsu Apartment Building, Tokyo, Japan. I. Parasitological Findings and Epidemiological Aspects. L. S. RITCHIE, 406th Medical General Laboratory, AND C. D. DAVIS, 385th Medical General Dispensary.

98. Parasitological Studies on the Far East. II. An Epidemiological Survey of Fukui Prefecture, Honshu, Japan. G. W. HUNTER, III, L. S. RITCHIE, K. NAGANO, AND N. ISHII, with the technical assistance of R. MIRAKUNI, R. E. WEBER, J. T. SZEWCZAK, AND S. ASAKURA, 406th Medical General Laboratory and National Institute of Health of Japan.

99. Parasitological Studies in the Far East. III. An Epidemiological Survey of Aomori Prefecture, Honshu, Japan. L. S. RITCHIE, G. W. HUNTER, III, C. PAN, J. T. SZEWCZAK, AND N. ISHII, with the technical assistance of S. IZUMI, R. E. WEBER, Y. HISHINUMA, AND S. ASAKURA, 406th Medical General Laboratory and the National Institute of Health of Japan.

100. Parasitological Studies in the Far East. IV. An Epidemiological Sur-

vey in Yamanashi Prefecture, Honshu, Japan. G. W. HUNTER, III, L. S. RITCHIE, E. H. KAUFMAN, C. PAN, J. T. SZEWCZAK, M. YOKOGAWA, AND N. ISHII, with the technical assistance of R. E. WEBER, F. WILLIAMS, JR., S. ASAKURA, AND Y. HISHINUMA, 406th Medical General Laboratory and National Institute of Health of Japan.

101. Incidence of *Dirofilaria immitis,* the Dog Heart Worm, in Dogs from Mississippi. JAMES W. WARD AND ROBERT C. REEDER, University of Mississippi.

102. Quantitative Studies on Nematode Parasites of Horses and Mules. JAMES W. WARD, University of Mississippi.

103. The Prophylactic and Suppressive Antimalarial Effect of Metachloridine with *Plasmodium cathemerium* in the Canary. WENDELL D. GINGRICH, University of Texas.

104. The Incidence of Trichinosis in Alabama as Indicated by the Examination of the Diaphragm and Three Other Muscles from 300 Autopsies. J. HENRY WALKER, University of Alabama.

105. Observations on the Life History of *Allocreadium ictaluri* Pearse. PHILIP G. SEITNER, Purdue University.

106 Methylene Blue Precipitated with Cadmium Chloride as a Restaining Agent for Blood and Tissue Protozoa. ERNEST HARTMAN, Chicago Medical School.

107. Blood Parasites of Birds from Kern County, California. CARLTON M. HERMAN, California Division of Fish and Game; WILLIAM C. REEVES, Hooper Foundation, University of California; AND H. ELLIOT MCCLURE, Communicable Disease Center, U.S. Public Health Service, Berkeley, California.

108. The Protozoan Fauna of Some Species of Intertidal Invertebrates in Southern California. HENRY I. HIRSHFIELD, University of Missouri.

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ABSTRACTS

1. *Comparative Studies on Cultivation and Antibiotic Treatment of the Human Intestinal Amoebae.* WILLIAM BALAMUTH, Northwestern University.

As a basis for in vitro studies, an attempt has been made to establish cultures of the human intestinal amoebae (with the exception of *E. histolytica,* good strains of which are already available). Many clinical specimens have been processed in various combinations of culture media, with the result at present that at least one strain of each species has been cultivated continuously for the past several months. Indirect evidence has been obtained of differences in growth requirements between the several species through inability to cultivate all of them in the same media despite imposition of a uniform bacterial flora. *E. coli* is growing on Loeffler's serum slants and egg slants with serum-Ringer overlay; *Iodamoeba* on egg slants with liver overlay; *Dientamoeba* and *Endolimax* in egg yolk infusion with liver supplement. Particulate rice starch is added to all cultures.

Antibiotics have been applied to each species with the object of establishing monobacterial cultures and thereby permitting more controlled study. All species have survived combined treatment with penicillin and streptomycin in concentrations as high as 500 units/ml. and 1000 units/ml. respectively. It has been found essential to define the experimental conditions carefully, to avoid eliminating the amoebae through indirect effects, as for example, presence of excess oxygen, too positive a redox potential, and absence of bacterial preconditioning of the medium. A standard procedure is being worked out to stabilize these variables, and additional antibiotics (including polymyxin) are being tested. (Supported by a grant from the National Institute of Health.)

2. *Oxidation-Reduction Potentials of* Entamoeba histolytica *in an Essentially Synthetic Medium.* JOHN L. BRADIN, JR., AND EDER L. HANSEN, University of California.

It has been shown that a negative oxidation-reduction potential is associated with the growth, encystation, and excystation of *E. histolytica* (Jacobs, 1941; Chang, 1946). Potentiometric determinations of oxidation-reduction and pH levels have been carried out on cultures of amoebae with associated bacteria growing in the essentially synthetic medium of Hansen and Anderson (1948). These observations have been made with the hope of more precisely defining the roles of reduction and anaerobiosis as factors required for the eventual maintenance of bacteria-free cultures of amoebae in this medium. An apparatus and technique are described for making these determinations at any desired time during incubation without interfering with the cultural conditions as they occur in "normal" stock cultures (Bradin, in press). Data showing the relationship between populations of amoebae, populations of bacteria, pH, and potentiometric measurements in millivolts are presented. These cultures include amoebae associated with monobacterial as well as mixed bacterial floras. Special attention has been given to the relationship of the early population levels to the development of a reduced condition in the medium.

It is recognized that these measurements of oxidation-reduction are taken on a mixture of substances containing no clearly defined electromotively active reversible systems. They cannot, therefore, be interpreted in terms of the ratio of total oxidant to total reductant but must be taken merely as an index of the approximate oxidation-reduction level in the medium. (This investigation is supported in part by a grant from the National Institute of Health.)

3. *A Biochemical Approach to the Problem of Cultivating* Endamoeba histolytica *Without Bacteria.* CHAS. W. REES, LUCY V. REARDON, AND HARRY D. BAERNSTEIN, National Institute of Health, with the collaboration of LESLIE HELLERMAN, Johns Hopkins University.

The fluid developed by Anfinsen, Geiman, McKee, Ormsbee, and Ball for cultivation of *Plasmodium knowlesi* was used in microcultures as an experimental medium for excystation of *Endamoeba histolytica* and for observation of the effects of specific compounds on the metacystic amoebae with the objective of ultimately ascertaining the requirements for growth of the organisms without bacteria. Modifications were made in technique by connecting the microtubes to larger tubes so that oxygen tension and pH could be regulated and chemical compounds added after excystation had occurred. A technique was developed for adding cysteine hydrochloride to the fluid and neutralizing the compound without exposure to air. Rates of excystation of around 1 per cent of the cysts were noted in the fluid without cysteine and as high as 30 per cent with cysteine in the amount of 0.05 M. Rates above 20 per cent occurred when the fluid was modified by omitting all organic compounds except cysteine. In the inorganic fluid the metacystic amoebae were found at 8 and 14 hours but not at 36 hours. In the fluid with added organic compounds including glucose, vitamins, purines, pyrimidines, cocarboxylase, and amino acids, they were found after 36 hours. Glucose alone with the inorganic salts had a marked effect on the longevity of the amoebae. The results show that excystation may be brought about in a fluid

containing measured inorganic compounds and cysteine and that some organic compounds unaffected by bacteria may be utilized by metacystic amoebae.

4. *Lipoidal Extract Cultivation Medium.* E. Clifford Nelson, Medical College of Virginia.

Lipoidal materials are ordinarily avoided in the preparation of cultivation medium, notwithstanding the recognized importance of lipoids in cell nutrition and metabolism. Promising results, presented before this group (Nelson, 1943), attended initial trial of a lipoidal extract medium and subsequent studies (Nelson, 1947) showed that a lipoidal extract could substitute for serum in a medium for *Endamoeba histolytica.*

Earlier studies concerned the use of an ethyl alcohol extract of tissue or egg yolk. Recently it has been found that ether, acetone and chloroform extracts are equally effective. The problem of handling lipoid material in the preparation of medium was satisfactorily solved when it was found that the material could be bound as an emulsion in hot agar solution and solid slants prepared.

Simple extracts are obtained by adding 50 cc of egg yolk or tissue to 450 cc of solvent. Solid material settles (ether, acetone, alcohol) or rises (chloroform) leaving about 400 cc of clear solution which is drawn off as needed, one cc of solution for each tube of medium to be prepared. Three egg yolks will thus provide for about 400 tubes of medium. The solvent is removed by evaporation on a boiling water bath and the extract incorporated in hot agar solution, two cc for each tube. Buffered saline overlay completes the medium.

A variety of intestinal amebae, flagellates and ciliates have been grown to date. Bacteria grow poorly and *Blastocystis* not at all.

5. *Axenic Cultures of* Neoaplectana glaseri *Steiner in Fluid Media.* Norman R. Stoll, Rockefeller Institute for Medical Research, Princeton, New Jersey.

This nemic pathogen of the Japanese beetle grub was brought to successful *in vitro* culture by R. W. Glaser on both non-sterile and sterile media. For the latter, dextrose agar slants with a piece of sterile rabbit kidney came to be preferred on account of the abundant production of life-cycle development. Making use of infective larvae obtained from the walls of such stock culture tubes, a study is in progress of diverse fluid media for rearing the organisms. Development obtains with small amounts of media in test tubes containing clumps of sterile glass wool and slanted. More recently, by omitting the glass wool and placing tubes upright in a shaking machine results have been more encouraging. Media (even in the relatively large amounts of 20 ml per tube) earlier regarded as inadequate have permitted development in the shaker. These include nutrient broth, or dilute serum, or culture media of known ingredients in which casein hydrolysate has supplemented, or been substituted for, the amino acids.

6. *P.V.A.-Fixative as a Preservative and Adhesive Solution for Staining Protozoa in Dysenteric Stool and Other Liquid Materials.* M. M. Brooke and Morris Goldman, Communicable Disease Center, U.S. Public Health Service, Atlanta, Georgia.

Until recently there has not been a satisfactory method of having purged or dysenteric stool specimens examined for protozoa by a distant laboratory, due to the fact that the trophozoites of the intestinal amoebae deteriorate rapidly. In order to meet this need, Goldman in 1947 reported a method of preserving intestinal protozoa by covering fecal smears with a water-soluble plastic, polyvinyl alcohol (P.V.A.), containing a modified Schaudinn's fixative. The present investigation was undertaken to adapt the principles of P.V.A.-fixative technique more effectively to the public health laboratory and to apply it to the study of other organisms.

The technique has been modified as follows: Instead of preparing smears, the specimen is fixed by mixing it in a vial with the liquid P.V.A.-fixative. Preserved in this liquid, the organisms can be shipped to the diagnostic laboratory, or stored without deterioration for several months. When stained smears are desired, a small amount of the preserved specimen is spread over the surface of a microscope slide. After the smear has dried thoroughly it is ready to be stained through the P.V.A. film since it is freely permeable to the staining reagents. In the original technique, the P.V.A. film was dissolved off before the smear was stained. The present method constitutes a decided advantage inasmuch as liquid specimens which ordinarily tend to wash off the slides during the staining procedure will adhere when mixed with the P.V.A.-fixative.

Apparently any small organism that will not be distorted during the drying of the P.V.A. film can be satisfactorily fixed, preserved, and stained with the present P.V.A.-fixative technique. Excellently stained slides of intestinal and free living protozoa have been prepared from stool specimens and cultures. In addition, satisfactory preparations of *Schistosoma mansoni* miracidia have been obtained.

7. *Changes of* E. histolytica. VIOLA MAE YOUNG, Hektoen Institute for Medical Research, Cook County Hospital, Chicago, Illinois.

Certain morphologic changes of *E. histolytica* under the influence of iodine drugs were reported previously (J. Parasitol., *32*, Suppl., 7, 1946). The present communication deals with the observation of the development of the so-called small form of *E. histolytica* in a child infected with the classic, large form of this organism while under treatment with an iodine drug. This change did not take place spontaneously *in vitro* in the original culture isolated from the patient before treatment during 40 subcultures. Experiments were carried out to reproduce such changes *in vitro* and to explain the higher resistance of the small form of *E. histolytica* toward iodine drugs.

8. *Chemotherapy of* Tritrichomonas foetus *Infections in Rabbits.* BANNER BILL MORGAN, University of Wisconsin.

A standardized, controlled *in vivo* technique utilizing female rabbits has been devised for testing trichomonicidal properties of various therapeutic compounds against *Tritrichomonas foetus*. The test is based on producing a vaginal infection in rabbits and administering the drug 5 days later. Vaginal swabs are made at frequent intervals to determine the efficacy of the compound. A total of 60 compounds were tested by this method. Only three compounds were effective on the first trial. These drugs when tested on ten rabbits each revealed the following results: tincture of iodine diluted to 1:4000, 6 out of 10 cures; 2 per cent entozon, 3 out of 10 cures; and sulfo-merthiolate (1 gram insufflated into the vagina), 5 out of 10 cures.

9. *Glucose Consumption of* Plasmodium gallinaceum in vitro. REGINALD D. MANWELL AND PHILIP FEIGELSON, Syracuse University.

Attempts to cultivate *Plasmodium gallinaceum,* using the medium and technique developed for *Plasmodium knowlesi* by Ball, Geiman, and others, have as yet met with only partial success. Studies initiated to determine the reason have included determinations of glucose consumption, which has been found to vary with age and surface area of the parasites. A formula for calculating the amount of glucose consumed per erythrocyte and per parasite was developed which agreed closely with observed experimental results. It was found that the glucose consumption per hour of a normal red cell was about 4.34×10^{-11} mg per hour, of a reticulocyte about 3.06×10^{-10}, of a small trophozoite with a surface area of 1 square micron 3.00×10^{-11}, and of a segmenter with an area of 48 square micra 1.44×10^{-9}. Increase in the amount of glucose in the medium considerably improved its performance for *Plasmodium gallinaceum,* although it is clear that other changes will also be required.

10. *Virulent Plasma in Malaria by* Plasmodium gallinaceum *Brumpt 1935.* JUAN BACIGALUPO, University of Buenos Aires.

We studied blood taken from chickens with chronic malaria to determine if the virus is found both in the plasma and cells. The majority of the latter produced infection while the former were negative.

Making the same investigations with parasitized blood, we find that in this case both cells and plasma give positive results. When examination of plasma and stained slides was negative, we filtered the plasma and obtained infections with this material. From five chickens inoculated, one was infected. Cultivations of plasma were negative. The infection had a 25-day incubation period.

11. *Effect of Worm Parasites on the Growth of and Feed Utilization by Pigs.* JOHN S. ANDREWS AND D. J. JONES, U.S. Bureau of Animal Industry.

At Tifton, Georgia, from 1944 to 1947, observations were made on the growth rate, feed consumption and acquisition of helminths by Duroc pigs farrowed and maintained until slaughter on a shaded lot contaminated with infective stages of internal parasites of common occurrence in swine in the southeastern coastal plain area. The soil of these lots became increasingly contaminated from year to year. Control pigs were farrowed and maintained on a well drained, unshaded lot kept reasonably free of parasite eggs and larvae by daily removal of feces. The pigs were autopsied when they attained a weight of approximately 215 pounds. The average number of worms per pig recovered from those on the contaminated lot varied from 2,654 in 1944 to 9,538 in 1947. The highest average number recovered per pig in the clean lot was 482. Compared to pigs of the clean lot, the growth of those on the unsanitary lot was retarded prior to the attainment of a weight of 35 pounds. Thereafter, the growth rate of both groups was about equal. However, during the third and fourth years of the experiment the pigs on the unsanitary lot required 0.8 and 0.5 pounds more feed, respectively, per pound of weight gain than those on the clean lot. On the basis of egg counts and numbers of worms recovered postmortem,

lungworms, ascarids, *Strongyloides,* and whipworms are considered as the principal cause of retardation of growth and decreased nutritional efficiency.

12. *The Destructoin of Horse Strongyle Larvae by Chemicals.* Norman D. Levine, University of Illinois.

The effect of 70 inorganic and organic compounds on horse strongyle larvae in feces was studied. All larvae were killed by 0.1% mercuric chloride, potassium iodide, sodium iodide, sodium arsenite, iodoform and nicotine sulfate. All larvae were killed by 1.0% boric acid, nitric acid, phosphoric acid, potassium bichromate, silver nitrate, sodium fluoride, sodium nitrate, arsanilic acid, chloral hydrate, formalin, Lethane B-72, orthophenylphenol, paraphenylene diamine, pentachlorophenol, phenol, resorcinol, salicylic acid, and tetraethylpyrophosphate. All larvae were not killed by 0.5% cupric chloride, sodium hypochlorite, and soap. All larvae were not killed by 1.0% ammonium hydroxide, ammonium chloride, hydrochloric acid, lead arsenate, potassium permanganate, sodium hydroxide, sulfuric acid, acetic acid, amidol, ANTU, benzil, carbarsone, chloramine T, gammexane, hexamethylenamine, hexylresorcinol, kojic acid, orthophenylphenate, oxalic acid, phenothiazine, pyrogallic acid, sulfanilamide, sulfaguanidine, tartar emetic, Tergitol 7, Triton X-45, and 2,4-D. All larvae were not killed by 1.0%, but were killed by 10% ammonium thiocyanate, sodium bicarbonate, sodium carbonate, diphenylamine, and Rutgers 612. All larvae were not killed by 10% sulfur, talcum powder, dibutylphthalate, DDT, and saturated aqueous picric acid solution, or by 5% sodium chlorate. All larvae were not killed by 0.1% crystal violet, 2000 units penicillin per gram, or 0.25 mg. tyrothricin per gram.

13. *Phenothiazine as a Larvicide Against the Hookworm of Cattle.* Roy L. Mayhew, Louisiana State University.

Thirteen experiments on pure infections of the hookworm of cattle (*Bunostomum phlebotomum*) have been completed using 4 different hosts varying in age from 6 months to 2 years. The results indicate that 1½ grams of phenothiazine given with the grain concentrate once a day for periods of 4 to 10 days prevented the development of infective larvae in 8 experiments involving all 4 hosts. One half gram was effective in preventing the developing of infective larvae in two experiments in a 6 months old calf, but was ineffective in one experiment and delayed in its action in two others in one host that was two years old. Daily fecal examinations indicated that eggs were produced continuously in all experiments.

14. *Ascarids a Cause of Loss to the Meat Industry through Condemnation of Swine Carcasses due to Icterus.* L. A. Spindler, U.S. Bureau of Animal Industry.

Occlusion of the bile ducts of swine by ascarids, *Ascaris lumbricoides,* has been found to be a cause of loss to the meat industry, the loss being due to condemnation of carcasses because of generalized icterus. From July, 1946 to July, 1947, 107,767 hog carcasses were condemned under Federal Meat Inspection. Of these, 8,870, about 8 per cent were condemned because of generalizd icterus associated with occlusion of the bile ducts by these worms. In general, the condition occurred most frequently in pigs farrowed in late summer and early fall and slaughtered the following spring, the peak of condemnations occurring in April and May. Detailed examinations of 7 icteric animals at time of slaughter showed the following: Occlusion of the bile ducts by live and/or dead, mature and/or immature ascarids; the number of worms occurring in the bile ducts of individual animals ranging from 1 to 16; hypertrophy and fibrosis of the hepatic lymph nodes and liver; hyperplasia of the bile duct walls; pus, blood, and fragments of worms and eggs in the bile duct and gall bladder contents; and intense icterus of the entire carcass. In one liver an ascarid had perforated a duct wall and was migrating beneath the capsule. The numbers of ascarids recovered from the small intestine of the animals examined ranged from 7 to 103; from the stomach as many as 7 live and/or dead worms were recovered. Causes of migration of the ascarids into the bile ducts and livers were not ascertained.

15. *Post-Cercarial Development of* Schistosoma mansoni *in the Rabbit and Hamster after Intraperitoneal and Percutaneous Infection.* Tamarath K. Yolles, Donald V. Moore and Henry E. Meleney, New York University.

Because of uniformly poor results from attempts to infect rabbits with *S. mansoni* by intraperitoneal injection of cercariae, a study was undertaken of the routes of migration and stages of development in various tissues and portions of the circulation of rabbits and hamsters following intraperitoneal and percutaneous infections.

It was found that in rabbits infected intraperitoneally a very small proportion of the worms were able to reach the lungs and portal circulation, leading to the conclusion that there was a high mortality in the peritoneal cavity or in adjacent tissues. This was in contrast to the finding that

in rabbits following percutaneous infection, and in hamsters following either intraperitoneal or percutaneous infection, a considerable proportion of the worms reached the lungs and portal circulation.

The development of worms which reached the lungs and portal circulation in rabbits infected intraperitoneally was slower than in rabbits infected percutaneously, suggesting that some of the worms from the intraperitoneal infections had suffered damage which was not apparent in worms from percutaneous infections. The development of worms to maturity in rabbits infected percutaneously was slower than in hamsters similarly infected, indicating that the rabbit is a less favorable host than the hamster for *S. mansoni.*

The nature of the condition in the peritoneal cavity which is unfavorable for the cercariae of *S. mansoni,* and its possible immunological significance, remain to be determined.

16. *The Number and Morphology of the Chromosomes of a Digenetic Trematode,* Rhopalias macracanthos *Chandler, 1932, from the Opossum.* Honorico Ciordia, University of Tennessee.

The chromosome number was found to be eight haploid, sixteen diploid, a number within the range found by Britt, 1947, in his studies of 35 digenetic trematodes. The latter indicate that aneuploidy has played a part in speciation in the trematodes already studied cytologically.

17. *Phenyl Mercuric Compounds for the Removal of Tapeworms from Poultry.* James E. Guthrie and Paul D. Harwood, Dr. Hess and Clark, Inc., Ashland, Ohio.

In controlled tests, dosage with fifty milligrams of certain phenyl mercuric compounds proved effective for the removal of tapeworms from experimentally infected birds. Phenyl mercuric phthalate removed 96.7 per cent of the *Raillietina cesticillus* present in 97 birds; phenyl mercuric borate removed 96.6 per cent, from 67 birds, and phenyl mercuric benzoate 92.8 per cent, from 59 birds. Other species tested thus far have proved less susceptible. Phenyl mercuric phthalate, for example, removed 69.6 per cent of the *Hymenolepis carioca* present in 44 birds and 49.8 per cent of the *Davainea proglottina* present in 20 birds. Since taeniacides are specific drugs, these results emphasize again the necessity of determining the effect of each drug upon each species of parasite involved. Phenyl mercuric phthalate removed 73 per cent of 74 *Ascaridia* from 11 experimentally infected chickens, but when combined with one-half gram of phenothiazine the same dose removed 97.6 per cent of 830 *Ascaridia* from 13 artificially infected chicks. These results suggest that the action of these two drugs may possibly prove additive against *Ascaridia.* The mixture in preliminary trials seems effective against *Heterakis* as well. Ten times the therapeutic dose of phenyl mercuric phthalate, namely, one-half gram, caused death in nearly one-third of the birds dosed, therefore, the therapeutic index is at least 10 to 1. Fifty milligrams of phenyl mercuric phthalate may cause a slight and transient enteritis in the host.

18. Pomatiopsis lapidaria (*Say*), *an American Intermediate Host for* Schistosoma japonicum. Elmer G. Berry and Ruth Elizabeth Rue, National Institutes of Health.

Recognition of the comparatively close relationship between members of the genera *Pomatiopsis* and *Oncomelania* led to morphological studies of species of *Pomatiopsis* and tests of their susceptibility to infection with *Schistosoma japonicum.* Experimental development of *S. japonicum*-like sporocysts in wild *P. lapidaria,* but failure to obtain cercariae, was reported by Stunkard (1946) and Ward, Travis, and Rue (1947). Subsequent intensive efforts at laboratory breeding of *P. lapidaria* were successful; from snails collected along the Potomac River banks near Washington, D.C. spherical eggs first observed in January 1947 were 1.2 mm in diameter, laid singly on sandy loam, coated with a sandy husk. Hatching nearly 3 weeks later, young snails averaged 0.816 mm in height, had 2 to 2.25 whorls.

Juvenile *P. lapidaria,* each exposed to 3 miracidia of *S. japonicum,* held at 80° F, showed sporocysts 57 days later. Cercariae were first observed upon mechanical rupture of a snail 75 days after exposure. Variations of environmental conditions were tested, to encourage shedding. Twenty-five cercariae emerged 105 days after exposure; additional cercariae were shed 2 days later. Hamsters were exposed to infection.

P. lapidaria, more widely distributed than other species of the genus, occurs from central United States to New York, from Michigan to Kentucky, possibly to Louisiana. With ecology like that of *Oncomelania,* it occurs on decaying leaves or marshy plants, on banks of streams or in seepage areas, is definitely amphibious but can withstand relatively long submergence, slightly negatively phototrophic and probably more active at night than during the day. It is morphologically nearer to *O. hupensis* than to other Asiatic species as shown by characters of radulae and genitalia.

19. *A Study on the Comparative Susceptibility of Snail Vectors to Strains of* Schistosoma mansoni. Virginia S. Files and Eloise B. Cram, National Institutes of Health.

A study was made of the relative susceptibility of *Australorbis glabratus* from Puerto Rico, Venezuela, and Brazil; *Biomphalaria pfeifferi* from Liberia; and *Biomphalaria boissyi* from Egypt to infection with *Schistosoma mansoni*. Strains of *S. mansoni* derived from four general sources, namely, Puerto Rico, Venezuela, Egypt, and a Brazil-Puerto Rican parasite cross were employed for exposure of approximately 2,100 *A. glabratus*, 200 *B. pfeifferi*, and 300 *B. boissyi*, all laboratory-reared. *A. glabratus* from Puerto Rico and Venezuela was readily infected with strains of *S. mansoni* from Puerto Rico, Venezuela, and Egypt and with the Brazil-Puerto Rican cross. However *A. glabratus* from Brazil was refractive to rodent and monkey strains of *S. mansoni* from Puerto Rico, Venezuela, and Egypt and susceptible only to Puerto Rican *S. mansoni* of human source and to the Brazil-Puerto Rican cross strain. *B. pfeifferi* was susceptible to all strains of *S. mansoni* while *B. boissyi* was refractive to all strains except *S. mansoni* of Egyptian origin. In summary, *A. glabratus* from Puerto Rico and Venezuela and *B. pfeifferi* from Liberia were more susceptible to the various strains of *S. mansoni* than was *A. glabratus* of Brazil or *B. boissyi* of Egypt. The possibility is discussed that these differences may be of significance in the epidemiology of schistosomiasis *mansoni*, past and future.

20. *Germinal Material in Rediae of Two Species of Trematodes from* Pomatiopsis lapidaria. D. J. Ameel, Kansas State College; W. W. Cort, Johns Hopkins University; and Anne Van der Woude, University of Michigan.

The germinal material was studied in the living rediae of a heterophyid, *Euryhelmis monorchis* Ameel, 1938, and an ophthalmoxiphidiocercaria, *Cercaria pomatiopsidis* Stimpson, 1865. No well-defined, persistent germinal masses were observed in either species like those we have described in certain echinostomes. In the younger rediae of both species there were groups of germinal cells at the posterior end of the body cavity. In the rediae of *E. monorchis* the body cavity at all stages, that were observed, was crowded with embryos, which escaped long before full development to continue their growth in the tissues of the snail. No germinal cells at the posterior end were present in the older rediae. In immature rediae of *C. pomatiopsidis* some small embryos remained attached to the group of germinal cells to form a simple germinal mass. However, the germinal cells in this species also had only a limited period of multiplication since in older rediae their number was gradually reduced until only embryos were present; the embryos developed into mature cercariae in the body cavity before they escaped. In both these species multiplication in the germinal sacs results in the production of rather small numbers of individuals.

21. *Notes on* Diphyllobothrium stemmacephalum *Cobbold, 1858*. Horace W. Stunkard, New York University.

Through the kindness of Professor J. J. C. Buckley, London School of Hygiene and Tropical Medicine, I received on loan two slides, one with a scolex and anterior proglottids and the other with eight gravid segments of *D. stemmacephalum*. The material is part of the original collection of Cobbold and the slides were made by him. The worms were dead and apparently partially decomposed when collected. The specimens were not stained and fixation, if attempted, was poor. The scolex is oval in lateral aspect, 0.3 mm long and 0.44 mm dorsoventrally. The scolex and first 264 proglottids measure 7.94 mm in length; the terminal segment is 0.07 mm long and 2.14 mm wide. The scolex is distinctly set off from the strobila which at the anterior end is 0.19 mm in thickness. The gravid proglottids are 11–12 mm wide and about 4.25 mm long. The tissues are so disintegrated that morphological details are obscure, but the uterus, filled with eggs, is conspicuous. There are 6–9, usually 8 uterine loops on each side and the terminal half of the last one is inflated and filled with dark-colored eggs. Eggs oval, operculate, 65–70 by 46–50 microns. Comparison of this material with specimens of *D. latum* discloses certain differences and further study may determine whether the two species, *D. stemmacephalum* and *D. latum* are to be regarded as congeneric or not.

22. *Speciation in the Cestoda*. Arthur W. Jones, University of Tennessee.

An attempt to account for speciation in the Cestoda must include explanations of such facts as the large number of but-once-reported species, the number of rare species, the difficulties in recognizing species in a familiar genus, such as *Dipylidium*, the generally high degree of host specificity among the known adult cestodes, as well as, where this has been described, intraspecific variation involving physiological, cytological or morphological strains and anomalies. The nature of cestode "populations", especially their cyclical fluctuation in size, suggests that genic change may become fixed in them more rapidly than in stable populations, as Sewall Wright has shown, mathematically; this would account in part for the numerous rare "species"

as actually genetically unique "populations". The nature of the genic changes themselves has been little investigated; cytological observations have shown inherent instability in chromosomal continuity in two species of cestode. Refined experimentation using laboratory reared populations is expected to yield more genetic information.

23. *A Gregarine from the Sand-crab,* Emerita analoga. Gordon H. Ball, University of California at Los Angeles.

About one-third of the sand crabs, *Emerita analoga,* examined in Southern California have been found infected with a cephaline gregarine placed provisionally in the genus *Carcinoecetes.* Infection is found mainly in the lobes of the digestive gland or liver although parasites occur also in the mid- and hind-gut. Intra-cellular stages are found in the liver and become septate before dropping out of the host cell. Syzygy occurs fairly late in development; solitary sporonts range from 180 μ to 520 μ in length; syzygies may reach a length of 700 μ. Multiple syzygies have been seen occasionally. In the living animal, the protomerite is very changeable in shape and acts frequently as a sucker. Both sporonts and syzygies show considerable motility and exhibit also a positive thigmotactic response. Cysts, which occur rarely in the sand-crab, have been found only in the lumen of the gut; they range from 150 μ to slightly over 300 μ in diameter. They are evidently discharged from the host before development of the gametes, as no older cysts have ever been seen in *Emerita.* Evidence indicates that transfer occurs from crab to crab. Final determination of the taxonomic status of this form depends upon the discovery of the development of the later cyst stages. Attempts to culture the motile or the cyst stages have so far proved unsuccessful. There is no evidence of seasonal distribution nor of any damage to the host.

24. *The Distribution of Pest Chiggers near Duke University.* G. W. Wharton, Duke University.

The distribution of pest chiggers near Duke University has been studied from several aspects during the last year and a half with the support of a grant-in-aid from the Division of Research Grants and Fellowships of the National Institute of Health, U.S. Public Health Service. Daily collections have been made and correlations with temperature and rainfall have been attempted. The last chigger of the 1947 series was collected on 20 October. The first specimen of 1948 was collected on 17 May. During 1947 the greatest number of specimens was collected during the last week in July and the first week in August. Larvae were uncommon when subsurface temperatures dropped below 60° F. Not enough data has been accumulated in this study to detect the seasonal effects of rainfall on the number of chiggers collected. The diurnal distribution of chiggers was investigated by making hourly observations continuously for 62 hours. Chiggers were collected most abundantly during daylight hours, but the temperature records indicate that the chiggers are most readily collected between temperatures ranging from 75 to 85° F, and that time of day is not of itself the controlling factor. During part of the time of the hourly observations rain fell. When the ground was covered by droplets of water few chiggers were collected. The distribution of chiggers in respect to soil and type of cover was also investigated. Chiggers were collected more frequently in loam than in either clay or sand. They were most common in brambles and practically non-existant under hardwood stands.

25. *The Incidence of* Leucocytozoon simondi *Mathis and Leger, 1910 Among Domestic Ducks in Northern Michigan.* Eli Chernin, Johns Hopkins University, and Elvio H. Sadun, University of Arkansas.

During the Summer of 1948 at the University of Michigan Biological Station, Cheboygan, Michigan, a survey was made of portions of Emmet and Cheboygan Counties to determine the existing incidence of this sporozoan disease of ducks. Between June 23 and June 30 a total of 43 ducks representing five sources were examined by blood smear and found to be negative. The first positive smears were recorded on July 10 from four of a flock of seven ducks six weeks of age. This flock was removed to the Biological Station and isolated on July 13, and all were found to be positive by July 17. The survey was continued during the period August 2 to August 7 with these results: 31 ducks of the original 43 were re-examined and all were found to harbor leucocytozoa. Six of seven ducks which had not been included in the original survey were also positive at this time. Seven additional ducks had died during the interim between surveys, but since the remainder of each of the two flocks to which they belonged was 100% infected, it is probable that the seven fatalities were due to that infection. Of eight ducklings exposed to natural infection from August 9 to August 30 in and near the Biological Station three survived, of which two were positive. It may be of interest to note that the farmers, agricultural agents, feed dealers, and others contacted in the course of the survey were almost uniformly unaware of the existence of the disease in their districts, and almost all concerned re-

garded the paucity of domestic ducks entirely as a function of an unfavorable economic situation with reference to their market value. Some evidence in the ducks studied indicates that a cyclical fluctuation in gametocyte level may occur in infections with *L. simondi*.

26. *The Occurrence of* Hypoderma *Larvae in the Spinal Canal of Cattle (Diptera: Oestridae).* Warren Haberman and Banner Bill Morgan, University of Wisconsin.

Of 946 larvae removed from the spinal canal of 278 infected cattle, 939 were identified as *Hypoderma bovis* and 7 as *H. lineatum*. The maximum number of larvae removed from a single infection was 21. The length of the larvae ranged from 5.0 to 17.0 mm and a progressive increase in the average length was noted from November (8.1 mm) to May (16.5 mm). *H. lineatum* larvae rarely have been found in the spinal canal. The increase in the average length of the larvae and in the number collected between October and June indicated the gradual accumulation in this region prior to appearing in the subdermal regions of the back. This occurrence corresponds with the well known aggregation of *H. lineatum* larvae in the submucosa of the esophagus. The variation in the number of larvae found per spinal canal corresponded favorably with the number of subcutaneous infections appearing later in a similar group of animals. Younger animals were found more heavily infected than older animals.

27. *Experiments on the Use of Quinoline Compounds for the Prevention of Blackhead in Turkeys.* Neal F. Morehouse, Dr. Salsbury's Laboratories, Charles City, Iowa.

8-hydroxyquinoline sulfate and four of its derivatives were tested to determine whether they had any preventive action against blackhead in turkeys. Only two treated birds and one control were used for testing 8-hydroxyquinoline sulfate. All other test groups and their controls were composed of four turkeys each. Starting on the day of infection, 8-hydroxyquinoline sulfate was given by capsule for 8 days at a daily dosage of 0.150 grams per bird. Diodoquin (5.7-diiodo-8-hydroxyquinoline) was given by capsule at daily dosages of 0.280 g and 0.560 g per kg of body weight for 10 days starting 3 days before infection. Two compounds, 5-chloro-6-iodo-8-hydroxyquinoline, at dosages of 1.0% and 0.5% in the feed and Chiniofon (7-iodo-8-hydroxyquinoline sulfonic acid) at dosages of 1.0%, 0.5%, 0.25% and 0.10% in the feed were given for 14 days starting 3 days before infection. Vioform (5-chloro-7-iodo-8-hydroxyquinoline) was given at dosages of 1.0% and 0.5% in the feed for 21 days starting 3 days before infection. The turkeys used for testing 8-hydroxyquinoline sulfate were infected by administering infected liver and cecal tissue but embryonated eggs of the cecal worm *Heterakis gallinae* were used as the transmitting medium for all other experiments. The only quinoline derivative which showed any value for the prevention of blackhead, when used at the dosages indicated, was Vioform. The successful prevention of blackhead by Vioform confirms the results obtained by DeVolt and Holst (Poultry Sci. 27: 256–258).

28. *Relation of the Gonadal Hormones to the Natural Resistance of Chickens and to the Growth of the Nematode,* Ascaridia galli. Elvio H. Sadun, University of Arkansas.

Moderate doses of testosterone propionate in immature male chickens and of alpha estradiol benzoate in immature female chickens increased their resistance to infections with *Ascaridia galli*. In six experiments in which 102 chickens were compared, the 51 controls had retained between 2.02 to 4.02 times as many worms as the 51 which had received moderate repeated injections of the homologous sex hormone. However, when very heavy doses of testosterone were injected, the number of worms harbored by the treated animals was 3.95 times as much as that of the controls.

When lethal egg doses were given the results seemed to indicate, although not conclusively, that the homologous sex hormone was also capable of conferring a resistance on the chickens that enabled them to survive longer.

Gonadal hormones influenced the development of the worms *in vivo* as shown by measurements of nearly 6,000 worms. The curves of growth of the worms recovered from males treated with testosterone and of those from females treated with estradiol were quite different from the normal curve of growth of worms recovered from untreated controls, and went in opposite directions. Injections of estradiol caused an initial retardation and a later increase in the mean rate of growth. Conversely, injections of testosterone caused an initial increase and a later retardation.

Further studies are needed to determine whether the action of gonadal hormones on the resistance may be related to the release of antibodies through the pituitary-adrenal cortex-lymphocytes chain of action.

29. *The Effect of Some Nematode Infections on the Leucocyte Count in Sheep.* JOHN T. LUCKER AND ELEANOR M. NEUMAYER, U.S. Bureau of Animal Industry.

Although existing reports suggest that *Cooperia, Trichostrongylus* and *Haemonchus* infections in sheep invariably are associated with leucocytosis, we (1946; 1947) did not find this condition in lambs experimentally infected with *Bunostomum.* Actually, average leucocyte counts diminished in most of the infected and all of the control lambs.

A similar decline in leucocyte level has been noted in fourteen of sixteen lambs infected experimentally with *Haemonchus* only, or with both *Haemonchus* and *Trichostrongylus.* In each of ten, which died of haemonchosis, the post-infection leucocyte average (three to nine weekly counts) was lower (0.62–4.32 thousands per cmm) than the same individual's preinfection average (two weekly counts). Appreciable declines occurred in four of six non-fatal infections; the averages in two survivors were practically unchanged. Since the average in the controls increased slightly, a relative leucopenia evidently occurred in at least some of the infected lambs.

In another experiment, counts in five of six lambs averaged lower after than before infection with *Haemonchus,* or *Trichostrongylus,* or both, but one control showed a decline also. The average decline in the controls was slightly greater than in the pure *Trichostrongylus* infections. Hence neither leucopenia nor leucocytosis was clearly demonstrated in this experiment.

Certain claims that the parasites named cause leucocytosis are based exclusively on comparative counts in infected and control sheep. Such comparisons are of doubtful significance because some normal individuals have a high, others a medium or low, leucocyte level.

30–40. Panel Discussion. Arthropod Vectors of Human Disease. CORNELIUS B. PHILIP, Vice-President, presiding.

No abstracts received.

41. *Chemotherapy of Experimental Trypanosomiasis with Certain Bis (2-methyl-4-amino-6-quinolyl) Amides and Ethers.* FRANS C. GOBLE, Sterling-Winthrop Research Institute, Rensselaer, New York.

A study was made of the *in vivo* trypanocidal activity of twenty-three quinaldine derivatives characterized by the presence of two identical 2-methyl-4-aminoquinoline constituents connected through the 6-position by bridges derived from urea, straight and branched chain dicarboxylic acids, or polymethylene glycols. The compounds were tested against the following: *T. cruzi* group (*T. cruzi,* 2 strains); *T. congolense* group (*T. congolense*); *T. brucei* group including 2 subgroups: *brucei* (*T. brucei, T. gambiense, T. rhodesiense*) and *evansi* (*T. hippicum, T. equiperdum*); *T. lewisi* group (*T. lewisi, T. duttoni*).

The compounds in which the bridge between the quinoline groups is not a branched chain (*i.e.,* the carbamide "Surfen", the malonamide through the sebacamide, and the quinolyloxy alkanes) are the most active against the *T. brucei* group but are inactive against *T. cruzi.* The branched chain compounds (disubstituted malonamides) in which the branches are short alkyl chains (methyl-methyl through ethyl-propyl and ethyl-allyl) are only weakly active against the *T. brucei* group but have activity against *T. cruzi* which increases directly with the length of the alkyl chains. The peak of activity against *T. cruzi* is reached in those drugs in which one branch is either propyl or allyl and the other branch contains 3 or more carbons in either aliphatic or aromatic arrangement. These latter compounds are completely inactive against the *T. brucei* group. None of the amides or ethers studied had appreciable activity in *T. congolense* infections, although a close relative, the cyanuric acid derivative bis (2-methyl-4-amino-6-quinolyl) melamine ("Surfen C" or "Congasin"), is known to be actively trypanocidal for *T. congolense* and *T. brucei.*

Preliminary screening and early evaluation tests were made in mice. The three compounds most active against the African hemoflagellates were studied further in infected rabbits, and the product most active against the *T. cruzi* (Bayer 7602) was used against experimental Chagas' disease in dogs.

42. *Influence of SH-inhibitors on the Oxygen Consumption of the Blood Stream Form of Some Trypanosomes.* THEODOR VON BRAND AND ELEANOR JOHNSON TOBIE, National Institutes of Health.

The blood stream forms of *Trypanosoma lewisi, T. cruzi, T. congolense, T. evansi, T. equiperdum, T. equinum,* and *T. gambiense* were subjected to various concentrations of some or all of the following inhibitors: iodoacetic acid, bromoacetic acid, bromobutyric acid, iodoacetamide, iodosobenzoic acid, sodium arsenite, mapharsen, and p-chloromercuribenzoic acid. The intensity of oxygen consumption as compared to uninhibited controls served as an index for the effectiveness of the compounds. The ranges of concentration varied between M/200 to M/25,000 and

M/5,000 to M/100,000, depending upon their activity. The most and the least effective inhibitor were mapharsen and bromobutyric acid respectively. Glutathione, cysteine, or BAL protected effectively *T. lewisi, T. evansi,* and *T. gambiense* against the arsenicals and p-chloromercuribenzoic acid. The SH compounds brought about at least a partial reversal of the inhibition induced by suitable concentrations of arsenicals and p-chloromercuribenzoic acid. The members of Hoare and Coutelen's group A (*T. cruzi* and *T. lewisi*) were definitely less sensitive to SH inhibitors than the trypanosomes belonging to group B, thus exhibiting exactly the reverse of what had been found previously in respect to the influence of cyanide.

43. *A Detailed Comparative Study of Cement Glands in Males of the Acanthocephala.* Harley J. Van Cleave, University of Illinois.

Superficial descriptions of cement glands of male acanthocephalans have overemphasized form differences while neglecting similarities and true distinctions. When histological details are considered three distinct types are recognizable:

1. A single syncytial gland with giant nuclei, characteristic of all Eoacanthocephala. This has a sacculate cement reservoir, chiefly external to it, although there is a definite passageway for communication. In no other group is there a separate reservoir.

2. Archiacanthocephala have eight uninucleate follicles, each with a separate duct. Each follicle contains within it a vesicular area around its central giant nucleus where cement accumulates.

3. Palaeacanthocephala show wide divergence in external form of the six or less follicles. Although highly variable in form the fundamental histology of the follicle types is identical. Each consists of a cortical glandular zone containing a relatively large number of nuclear fragments surrounding a vesicular space for cement storage.

As a phylogenetic series the single syncytial cement gland seems to be the most generalized. The compound glands in Archiacanthocephala and Palaeacanthocephala represent modifications from the Eoacanthocephalan type thereby supporting recognition of the Class Metacanthocephala as a natural group. The greatly diversified compound syncytial glands of the Palaeacanthocephala seem to represent the most highly specialized condition.

Evidences furnished by the cement glands support the evolutionary pattern earlier worked out showing parallel phylogenetic and ontogenetic modifications in the nuclei of the subcuticula of the Acanthocephala.

44. *The Prognosis of Mal del Pinto (Pinta or Carate).* Eduardo Aguirre Pequeño, University of Nuevo León, Monterrey.

Primary infection with Pinta usually occurs in children from 4 to 10 years of age. The dermatological changes frequently produce psychic disturbance not unlike those found in lepers and are most accentuated in well-to-do patients.

Because of the irreparable lesions (leukodermias, atrophodermas) of the non-spontaneous cure, of the resistance to treatment and the sometimes immutable perseverance of the serological reactions, "el mal del pinto" (pinta or carate) must be considered to have a serious prognosis from the standpoint of legal medicine as well as from the social and labor point of view.

45. *Infection Experiments with the Filarial Worms of the Cotton Rat.* Etta Mae Macdonald and J. Allen Scott, University of Texas.

These studies have dealt with the introduction of infective larvae of *Litomosoides carinii* into the body of the cotton rat. They have been introduced into several sites including the stomach, the abdominal cavity and subcutaneous spaces. Several different methods of introducing the larvae have also been used including stomach tube, hypodermic needle and surgery. In some cases the larvae had been dissected from the mites, in others the intact mites were introduced, while in still others mites whose integument had been slightly cut were introduced. The experiments have provided preliminary information on the natural method of transmission and on migration within the body of the cotton rat.

46. *Comparative Studies on the Anatomical Structures of the Third and Fourth Stage Larvae of the Filarial Worms of the Cotton Rat.* J. Allen Scott and Etta Mae Macdonald, University of Texas.

Studies have been made for the purpose of detecting changes in the structures of the larvae of *Litomosoides carinii* during the early stages of growth in the cotton rat. Especial attention has been paid to the sclerotized lining of the stoma and to the developing reproductive systems. The infective larvae dissected from mites were studied as a base against which further changes could be compared. Larvae recovered from rats infected for various definite periods revealed

progressive changes throughout the balance of the third stage and after the moult into the fourth stage.

47. *Humidity Requirements of* Ascaris lumbricoides *var.* suum *ova.* Aaron Seamster, Del Mar College.

Use of an American Instrument Company Climatizer permitted exposure of swine-ascarid ova to accurately controlled conditions of temperature and humidity. Preliminary results indicate that humidity requirements of these ova are higher than previously reported.

Ova smeared on glass slides and exposed to circulating air of 80, 85, and 95 per cent relative humidity at a constant temperature of 31.1° C failed to develop past the morula stage and were desiccated beyond recovery after 8 days exposure to the above conditions.

Ova exposed at 26.7 and 28.9° C to a constant relative humidity of 95 per cent developed to the motile embryo stage but required approximately 8 per cent more time to complete development than controls maintained at 100 per cent relative humidity.

48. *Variation in Distribution of Wisconsin Fish Parasites.* Ralph V. Bangham, College of Wooster.

During the summers of 1943 through 1948 and the college year of 1947 to 1948 a parasite survey of Wisconsin fishes resulted in the examination of 13,855 fish belonging to 85 different species. Of these, 12,613 or 91 per cent were infected with at least one species of parasite. Degree of infection and numbers of different parasites are discussed for several habitats; very soft water lakes, soft water lakes, northern and southern hard water lakes, trout streams, impounded areas, and the Upper Mississippi River. Very soft water lakes show the absence or great reduction of digenetic flukes and Acanthocephala. Soft water lakes show an increasing number of parasites with the highest both in degree and in number of infecting forms being recovered from northern hard water lakes. Trout streams show a larger number of hosts free of parasites and fewer species of infecting forms. Newly impounded areas often have parasite life cycles disturbed and for a few years yield hosts with relatively few parasites. Degree and intensity of infection increase after a few years. Fish from the Upper Mississippi yield numbers of parasite species above that of trout stream fish but not as high infection as found in fish of most hard water lakes. Parasite species characteristic of the different habitats are discussed briefly and parasites most frequently encountered are listed.

49. *Reflections of a Medical Parasitologist.* Ernest Carroll Faust, Tulane University. Presidential Address.

50. *Chemotherapy of Experimental Amoebiasis in Rats and Mice.* Ashton C. Cuckler and Christine Malanga, Merck Institute for Therapeutic Research, Rahway, New Jersey.

The *in vivo* activity of potential amoebicides has been difficult to evaluate because of the lack of an experimental host which can be infected in large numbers. In the past kittens, dogs, monkeys, rats and mice have been used with varying success. The report by Jones (Ann. Trop. Med. and Parasitol., *40,* 130–140, 1946) on the successful experimental infection of young rats has stimulated further interest in evaluation of anti-amoebic compounds. Recently we have obtained uniformly satisfactory results using young rats, and mice, as experimental hosts for *Endamoeba histolytica.* The strains of animals and amoebae used, the methods of culture maintenance, inoculation, experimental therapy and evaluation of results are described and illustrated.

51. *Progress Report on a Study of Methods of Pinworm Diagnosis.* Paul C. Beaver, Tulane University. and Georgia Department of Public Health.

With only slight modification of the methods of pinworm diagnosis originally described by Hall (1937, Am. J. Trop. Med. 17: 445–453), Jacobs (1942, J. Pediatrics 21: 497–503) and Schüffner and Swellengrebel (1944, Zent. f. Bakt. I Abt. Orig. 151: 114–122) respectively, the NIH, Scotch tape, and wet pestle types of perianal swabs have been compared. In one series, NIH swabs were taken first, followed immediately by the wet pestle. Of 187 positive cases, 91 per cent were positive by wet pestle as compared with 75 per cent by NIH. The average number of eggs recovered was 95 in the wet pestle and 68 in the NIH preparations. Thus the wet pestle is the more efficient. It has the further advantage of requiring much less time for microscopic examination. On the basis of 62 positive examinations, the Scotch tape appears to be more efficient than the wet pestle. All 62 cases were positive by the Scotch tape whereas the pestle technic failed in 11 instances and the tape samples contained an average of 1,122 eggs as compared with 82 in the average positive pestle preparation. However, since the wet pestle swabs were taken immediately after the Scotch tape, the tests definitely favored the latter. Ob-

servations to date indicate that both the pestle and the Scotch tape are highly reliable technics and that a choice of one over the other would be based on considerations other than relative efficiency. The pestle requires more time and materials at the patient but less time at the microscope, especially for the examination of negative preparations.

52. *Metachromatic Determination of Mucoprotein Distribution in* Paragonimus kellicotti. Francis J. Kruidenier, University of Illinois.

Presumptive mucin-mucoprotein distribution in mature *Paragonimus kellicotti* was determined on the basis of metachromatic thionin and toluidin blue O reactions following varied fixation. Differentiation in alcohol and acetone was employed, and results were correlated with mucicarmine and the Leach Bismark brown techniques on the same species and on other species of trematodes where structural similarities permitted. Unicellular glands of the digestive tract, including oral, pharyngeal, esophageal, and those around the anterior portions of intestinal crura are mucoid, as are similar internal glands of the suckers that may function in adhesion, the subcuticular glands that contribute a basal stratum of mucoid to the cuticula and cells that empty into a terminal duct for excretory bladder evacuation. Mucoid glands empty into Laurer's canal and surround the genital atrium and the terminal portions of vas deferens and metraterm. Intestinal epithelia contain heavy mucoid deposits. Diffuse metachromatic droplets aggregate during vitelline cell development, concentrate adjacent to nuclei during passage through vitelline ducts, and persist in degenerating vitelline cells in uterine eggs. Mucoid substances form diffusely in developing ova, are more concentrated in spermatozoa, and function in the formation of a fertilization membrane; they are distributed in the cells of the nervous system. Nuclear, nucleolar, very diffuse cytoplasmic and membrane reactions indicate that careful technical manipulations with cautious interpretation of results and further controlled experimentation is necessary. More general polysaccharide-protein linkages may be involved in such metachromatic reactions than the reports of many authors indicate.

53. *Crystals in Opalinids.* J. L. Mohr, University of Southern California.

Rhomboidal, reddish-brown crystals, presumed to be bilirubin, have been reported from European opalinids. The occurrence of similar crystals in *Protoopalina* from Florida, *Opalina* from Oklahoma and California, and *Zelleriella* from Cuba is here reported. In these latter cases the anuran hosts had been in captivity for varying periods and the intestinal and cloacal contents were suffused with green (bile?). Crystal growth within opalinids was observed and was attended by decrease of greenness of the ambiant fluid. Cysts as well as trophic ciliates contained crystals. In opalinids in smears fixed and stained routinely, the crystals were dissolved in some cases leaving rhomboidal spaces in the cytoplasm. The zellerielles demonstrated were fixed in a solution of 1 gram of barium chloride in 10 cc of reagent formaldehyde and 90 cc of water, stained in Heidenhain's hematoxylin and mounted in glychrogel.

54. *Ultra-rapid Demonstration of Unicellular Blood Parasites in Minimum Concentrations by Thedane Blue Methods.* H. C. R. Simons, National Research Council.

Thedane blue, T.B. (saponin-methylene blue addition compound; Negociateur Ltd., Münchenstein, Switzerland), synthesized by the author, markedly simplifies all current thick film methods. It accomplishes within seconds what formerly took 2–3 hours and is applicable to demonstration of trypanosomes, human malarial plasmodia (pigmented forms only, especially crescents), bird malaria, blood- and syphilis-spirochetes, leptospirae, piroplasms, and probably also microfilariae.

The "ultra-thick wet drop" (100mm^3 blood or more) is the method of choice for all human animal mass examinations in trypanoses, spirochetoses, piroplasmoses, and for testing large series of laboratory animals.

T.B.-methods avoid "occult parasite flotation," i.e. uncontrollable loss of parasites as in Giemsa methods, because there is no dilution, tilting, or rinsing.

The diagnostic importance of T.B.-darkfields in leptospirae, spirochetes and treponemes is their red color by selective diffraction (*Berek* effect, B.E.).

Extremely small amounts of parasites can be accurately diagnosed at surprisingly low magnifications. In bright- and dark-field oil immersion is unnecessary for demonstrating above parasites. Darkfield is only necessary in leptospirae and treponemes, but B.E. greatly facilitates rapid diagnosis of all blood spirochetes.

In rabbit syphilis (author) and in human syphilitic mouth lesions T.B. proved to be very valuable diagnostically. Bijdendijk (1947) found *T. pallidum* unstained while accompanying mouth spirochetes appeared red by B.E.

All routine centrifugation methods for concentrating extracellular blood protozoa have

proven to be unreliable on re-examination. Reliable, time-saving centrifugation was obtained by $CUSO_4$- and $Zn(OH)_2$-precipitates. The deposits including all parasites are dissolved chemically, the parasites remaining intact.

55. *Studies on the Cestode Genus* Paruterina (*Cestoda: Dilepididae*). R. Rausch, Everett L. Schiller, and Banner Bill Morgan, University of Wisconsin.

Cestodes of the genus *Paruterina* are rare and poorly known in North America. Studies have been made on four species, *P. candelabraria* (Goeze, 1782) from owls, *P, similis* (Ransom, 1909) from the yellow-billed cuckoo, and two species not previously recorded, from the rock wren and the green-tailed towhee. Cysticercoids of *P. candelabraria* were obtained experimentally in the liver of laboratory mice.

56. *Studies on Species of* Paranoplocephala *Parasitic in North American Rodents* (*Cestoda: Anoplocephalidae*). R. Rausch, Banner Bill Morgan, and Everett L. Schiller, University of Wisconsin.

A study has been made of the North American species of *Paranoplocephala* parasitic in rodents. Certain nomenclatural changes have been made, with the result that three species are considered valid. Testes number and testes distribution have been considered of particular taxonomic value. A paper in press gives complete details, along with nomenclatural changes.

57. *Variation in* Andrya macrocephala *Douthitt, 1915* (*Cestoda: Anoplocephalidae*). R. Rausch, Everett L. Schiller, and Banner Bill Morgan, University of Wisconsin.

A large series of *Andrya macrocephala* Douthitt, 1915, has been examined from a variety of host species (*Geomys bursarius* Shaw; *Thomomys talpoides tenellus* Goldman; *Sigmodon h. hispidus* Say and Ord; *Microtus p. pennsylvanicus* Ord; *M. pennsylvanicus drummondii* (Audubon and Bachman); *M. pennsylvanicus modestus* (Baird); *M. ochrogaster* (Wagner); *M. townsendii* (Bachman); *M. townsendii pugeti* Dalquest; *M. richardsoni macropus* (Merriam); *Ondatra z. zibethica* L.). The study of this material has disclosed a considerable amount of variation in testes distribution and testes number. Since these characters have been commonly used to differentiate species of *Andrya,* it becomes necessary to consider other characters. A paper in press gives complete data, along with certain nomenclatural changes.

58. Apororhynchus *sp.* (*Apororhynchidae: Acanthocephala*) *from North American Birds.* Elon E. Byrd and J. Fred Denton, University of Georgia.

A single host specimen of two species of warblers (Canada and Parula) has been found to be infected by an acanthocephalan parasite tentatively identified as belonging to the genus *Apororhynchus* Shipley, 1897. Sixteen and seven parasites respectively were taken from the two infected birds. In each case the worms were fastened to the inner lining of the posterior portion of the digestive tube at about the point where ectodermal and endodermal tissues meet.

The parasite is small, usually less than 3 mm in length and about 1 mm in maximum width. The proboscis is clearly bubular in shape, is rather thin-walled, and bears many small thumbtack-like spines. There is no receptacle. More than 130 ovarian fragments have been counted in the mature female, while 4 pairs of cement glands occur in the male. The lemnisci are about twice the length of the body and usually contain from 9 to 11 giant nuclei. From 28 to 31 giant nuclei have been observed in the posterior two-thirds of the main body wall. The uterine bell of the female and the eversible bursa of the male are moderately developed. Ova may be with or without shells; they measure 48 to 64 μ in length by 24 to 30 μ in width.

In so far as we have been able to determine, acanthocephala of this type have not been reported previously from North American birds.

59. *Apparatus and Methods for Raising and Handling Tropical Rat Mites.* J. Allen Scott, University of Texas.

The demonstration shows apparatus which has been devised for raising tropical rat mites, infecting them with the filarial worms of the cotton rat and handling them in large numbers. Photographs of larger installations will also be displayed as well as charts showing some of the results obtained.

60. *Studies on a Haemogregarine from the Leopard Frog.* John K. Bailey, University of Tennessee.

Haemogregarines in the blood and other tissues of the Leopard Frog were studied in hanging drop preparations, blood smears, smears of macerated tissue, and sections. Motile forms were observed distorting by contact, and occasionally entering erythrocytes. Small and intermediate

forms were found in erythroblasts. Infection of "clean" frogs was accomplished by several methods of injection. It is believed that the parasite studied has a schizogonous cycle in the blood, with frequent formation of gametocytes. The fate of the latter can be determined by completing a study of the life cycle.

61. *The Chromosomes of* Macracanthorhynchus hirudinaceus, *the Giant Thorny-headed Worm.* Helen L. Ward, University of Tennessee.

The chromosomes of *Macracanthorhynchus hirudinaceus* have been studied by modern cytological methods. Meyer's (1933) descriptions may be emended as follows: the chromosome number appears to be constant; there are two sets of three, making the diploid complement six, and it appears that in the male the two long chromosomes are heteromorphic. The large size of these chromosomes makes detailed study possible.

62. *Susceptibility of Two Species of Louisiana* Tropicorbis *to* Schistosoma mansoni. Russell Michael McQuay Jr., Tulane University.

Colonies of snails from two *Tropicorbis havanensis* collected in Baton Rouge, La. and from several specimens of a *Tropicorbis* species from Audubon Park, New Orleans, La. were established in the laboratory. The progeny of well-established *T. havanensis* were exposed to miracidia of *S. mansoni* and progeny of these exposed snails were maintained in separate aquaria. Laboratory-bred *Australorbis glabratus* were employed as controls in each experiment. All of the positive *T. havanensis* and most of the other experimental snails were 3 to 6 mm when exposed. Two strains of *S. mansoni* were tested, one a Puerto Rican and the other a strain from an infection of unknown origin in a Guinea baboon (*Papio papio*). Altogether, 818 experimental *Tropicorbis* were exposed. Of the 624 which survived the experimental period, 255 were *T. havanensis,* on which the following results were obtained: Mass exposure of 93 snails to miracidia of the Puerto Rican strain produced 12 which shed cercariae; 5 of these are of special interest because they were from a group of 15 which were the progeny of snails that had earlier shed cercariae; 61 exposed to 5 miracidia each, also of the Puerto Rican strain, gave negative results; and 101 given mass exposure, using the baboon strain, were also negative. A total of 369 survivors of 486 similarly exposed Audubon Park stock failed to shed cercariae. All surviving *Australorbis* controls for both strains of *S. mansoni* developed infection. These observations confirm those of Cram and Files (1945, 1946) who found that *T. havanensis* from Baton Rouge is susceptible to *S. mansoni* infection of Puerto Rican origin, whereas the *Tropicorbis* from Audubon Park failed to become infected.

63. *Dicrocoeliid Trematodes of North American Birds.* J. Fred Denton and Elon E. Byrd, University of Georgia.

During the past sixteen years some 700 wild birds representing 120 species have been examined for dicrocoeliid trematodes. These birds were collected from various localities in the southeastern United States: Mountain Lake, Va., Highlands, N. C., Athens and Augusta, Ga., State College, Miss., Reelfoot Lake, Tenn., and Houston and Eagle Lake, Texas. In addition many dicrocoeliids collected from birds by workers in other localities in the United States were generously loaned for study.

Twenty-eight of the bird species were found harbouring 20 species of flukes of the family Dicrocoeliidae belonging to 8 genera as follows: *Lyperosomum* Looss, 1899, one species; *Brachylecithum* Strom, 1940, ten species; *Lutztrema* Travassos, 1941, two species; *Athesmia* Looss, 1899, one species; *Eurytrema* Looss, 1907, one species; *Platynosomum* Looss, 1907, one species; *Skrjabinus* Bhalerao, 1936, two species; and *Zonorchis* Travassos, 1944, two species. Apparently 12 of the 20 species are undescribed forms.

The birds infected with the largest number of species of flukes were the blue jay, *Cyanocitta cristata,* with six species; the red-eyed towhee, *Pipilo erythrophthalmus,* with four species; and the brown thrasher, *Toxostoma rufum,* and mesquite grackle, *Cassidix mexicanus prosopidicola,* with three species each.

64. *An Improved Ruling for the Ocular Disc of Special Usefulness in Parasitology.* Edward P. Offutt, University of Rochester.

At the last annual meeting of the American Society of Parasitologists the author described a new ruling for the ocular disc which had been found useful in his teaching of students in medical parasitology. During the demonstration of models of this ruling several improvements were suggested by interested individuals. These improvements have been incorporated in the engraved ruling that will be demonstrated.

Arrangements have been completed to have the ruling reproduced on optical glass by photographic techniques so that this piece of equipment may be generally available at a reasonable cost.

65. *Some New Concepts in the Embryology of Nematodes.* ARTHUR E. WOODHEAD, University of Michigan.

Some Nematodes, high up in the scheme of classification, which pass their third or fourth larval stages in the northern bullhead, show an interesting method of securing food materials from their host and storing this for use by the next larval stage. This method on a reduced scale is somewhat similar to that exhibited by the Gordiacea larva in the cricket.

66. *Vaginal Sphincter, New Organ of* Echinococcus granulosus. JUAN BACIGALUPO AND ENRIQUE RIVERO, University of Buenos Aires.

Echinococcus granulosus has been demonstrated to possess a muscular vaginal sphincter. It is possible that this sphincter serves as an aspirating pump for spermatozoa. This organ is similar to that described by R. de Noyer and Baer in the vagina of *T. saginata* in 1928.

67. *A Simplified Method of Displaying 2″×2″ Color Slides.* LEONARD REID DAVIS AND DALE A. PORTER, U.S. Regional Animal Disease Research Laboratory, Auburn, Alabama.

A war surplus lamp head from a "Lamp Assembly Flood Light Portable Fluorescent Type B-5" was used as a 2″×2″ slide display unit. A sheet of 2-ply Bristol Board was used in lieu of the 6 metal reflectors behind the fluorescent tubes. One layer of tracing cloth diffused the light. Aluminum divider strips which were normally used for joining sheets of wall board, were cut 19″ long and were notched at each end so that they fitted into the metal frame. These strips were arranged so that they held 9 vertical rows of 9 slides. Slides are replaced by removing the upper metal strip. The unit can be displayed on the original lamp stand or as an easel on a table. The same system can be used with an x-ray viewing box instead of the lamp head described above.

68. *Incidence of* Endamoeba histolytica *and Other Parasites of Man in Wisconsin. I. Preliminary Report on a Group of College Students.* DAVID R. LINCICOME, WALTER H. THIEDE, AND ELIZABETH H. CARPENTER, University of Wisconsin.

A group of 1110 University of Wisconsin students with and without war service has been examined for intestinal parasites utilizing the direct film, the $ZnSO_4$ centrifugal flotation and hemotoxylin film technics. Each student was examined once. Seven organisms have been found: *Endamoeba histolytica, Endamoeba coli, Endolimax nana, Iodamoeba bütschlii, Giardia lamblia,* hookworm and *Trichocephalus trichiurus.*

Of overseas veterans 32% were infected as were 22% of those with domestic service only and 27% of those with no war service. Of overseas veterans 4.5% were infected with *E. histolytica* as were 2.5% of domestic veterans and 1.6% of those with no war record.

Total incidence figures according to theater of operations varied from 38% in the Greenland, Iceland and Alaska areas, 35% in South and Central America and CBI theaters, 32% in the Mediterranean to 30% in the ETO and Pacific commands. Incidence of *E. histolytica* infections ranged from 11% in the Mediterranean to 10% in the CBI, to 5% in the general Pacific area and 1.4% in the ETO.

From these preliminary figures in comparison with published data and in consideration of the interval of time since the termination of the war, it is estimated that there has been no significant increase in incidence of infection with *E. histolytica* in the so-called middle-western area of the United States as a result of the recent war. The data here comprise the first systematic study of the incidence of human parasitic infections in the State of Wisconsin.

69. *Observations on the Life Cycle of* Neoechinorhynchus emydis, *an Acanthocephalan Parasite of Turtles.* DAVID R. LINCICOME, University of Wisconsin.

The significance of the recent discovery of *Neoechinorhynchus emydis* juveniles in *Campeloma rufum* and *Ceriphasia semicarinata* has not been apparent, since the intercalation of snails in acanthocephalan life cycles does not conform to well established patterns. In order to determine the manner in which snails become infected, experiments were undertaken to test the suitability of arthropods as hosts for the developmental stages of this parasite and therefore as possible vectors of the worm to snails and/or to the definitive host.

Adult female *Neoechinorhynchus emydis,* freshly collected from turtles purchased from a dealer, were crushed in saline to obtain eggs. These were stored under refrigeration until used. Two groups of arthropods were exposed to mature eggs, and observed for periods up to eleven days for evidence of 1) ingestion of eggs, 2) hatching of eggs, and 3) development of hatched larvae. One group was composed of the abundant amphipod, *Hyalella knickerbockeri,* collected

from Lake Mendota, Madison, Wisconsin. Neither eggs nor hatched larvae were detected in the gut contents of this amphipod. The second group was composed of laboratory-reared ostracods identified by Dr. C. C. Hoff of the University of New Mexico as *Cyprinotus incongruens* (Ramdohr, 1808). These were from stock collected at Lexington, Kentucky. Twenty-four hours after exposure to eggs, hatched larvae were recovered from gut contents. Swollen larvae, typical of early developmental forms of other neoechinorhynchids in arthropods, were observed. Viable and motile larvae were recovered from gut contents up to five days after exposure.

70. *Distribution of* Leptorhynchoides thecatus, *a Common Acanthocephalan Parasitic in Fishes.* David R. Lincicome, University of Wisconsin.

Leptorhynchoides thecatus has been recorded from 83 vertebrate host species either as a parasite encysted in the mesenteries or as a juvenile or mature form in the gut. Seventy-nine of these hosts are fishes while two are amphibians and two are reptiles.

The record of occurrence in fishes along the coast of Wales in Great Britain by Rees 1945 is considered erroneous, as specimens upon which this report was based have been examined and are considered to be a species of *Echinorhynchus.* Hence the records for two fishes in Europe have been deleted from the list of hosts.

Host animals carrying this worm have been recorded in 13 of the United States extending on the eastern seaboard from New England to Florida and westward through the Ohio valley to the Mississippi River. In addition there are records from the Canadian province of Ontario and from Iowa and Minnesota which constitute the only instances west of the Mississippi River.

71. *Experimental Infections of Pigs with* Oesophagostomum dentatum *and* O. longicaudum. Doys A. Shorb, U. S. Bureau of Animal Industry.

Pigs, 47 days to 8 months old, were infected by mouth with 200 to 1,178,000 larvae of *Oesophagostomum dentatum;* other pigs were infected with approximately equal numbers of *O. longicaudum* larvae. The infected pigs were autopsied 20 hours to 226 days after infection to determine the stage of development of the worms and the associated lesions. Twenty hours after infection encysted larvae of both species were found in the mucosa and submucosa of the cecum and large intestine; in the heavy infections the mucosa was eroded and haemorrhagic. Six to 10 days after infection fourth-stage larvae of both species had emerged from the nodules into the lumen of the intestine. In light infections (less than 1,000 larvae) the intestine was only slightly hyperaemic. In heavier infections (10,000 to 130,000 larvae) there were hypertrophy of the regional lymph nodes, marked oedema of the meso-colon, and thickening of the intestinal wall with widespread haemorrhages in the mucosa, the latter being covered by a diphtheritic membrane with feces adhering to its surface. In the heaviest infections (more than 130,000 larvae) the lesions were exacerbated. Prior to autopsy, severely affected animals showed anorexia, constipation, sometimes diarrhea, and emaciation, terminating in death in the severest cases. Pigs which survived heavy infections were usually retarded in growth. In general, even in heaviest cases the diphtheritic membrane did not persist longer than approximately 6 weeks.

72. *Folliculinids Associated with* Limnoria *in California and Washington.* J. L. Mohr and J. A. LeVeque, University of Southern California.

Mirofolliculina limnoriae Dons has been found on *Limnoria lignorum* (Rathke) at Newport Harbor, California, being somewhat more prevalent in winter months. A shorter series of observations (August, 1948) at Friday Harbor, Washington, found *M. limnoriae* present on large numbers of the isopods in some pilings attacked. They were not taken in the groups collected from Brown Island and the town piers but infested 10 to 70% of batches from Oceanographic Laboratories' pier. Up to five *Mirofolliculina* tests were seen on the telson and neighboring dorsum of one isopod. This folliculinid was not observed in the wood of burrows.

Only at the laboratories pier, *Folliculina gunneri* Dons was observed on the ventral surface just behind the head of *Limnoria.* About 11% of individuals in infested groups had this form, which was seen occasionally attached to wood of the galleries. *Folliculinopsis lignicola* Faure-Fremiet was observed in some numbers twice during these studies, living in the tracheids of the wood about the galleries and apparently coloring the adjacent tracheid walls bluish. *F. gunneri* and *F. lignicola* were not observed at Newport.

73. *The Cyclic Transmission of Japanese Encephalitis by* Culex quinquefasciatus, *Utilizing Young Albino Mice.* Herbert S. Hurlbut and John I. Thomas, Naval Medical Research Institute.

The purpose of the experiment was to demonstrate a complete transmission cycle of Japanese encephalitis virus using the mosquito, *Culex quinquefasciatus,* and young albino mice. Mice six

days old were infected with the virus by being bitten by infected mosquitoes. Normal mosquitoes were permitted to engorge on these mice 48, 72 and 90 hours after the infective bites were received. Each of four mice bitten by the 48-hour group of mosquitoes developed encephalitis in four to five days. One of two mice bitten by mosquitoes of the 90-hour group developed encephalitis. The two mice bitten by the 72-hour group of mosquitoes remained normal. Virus was demonstrated in the brains of the infected mice by brain passage and by neutralization tests.

The results indicate that *Culex quinquefasciatus* can be readily infected with the virus of Japanese encephalitis by biting young albino mice in the early stages of the disease and that these mosquitoes are capable of transmitting the infection thus acquired. The blood of mice in the later stages of the disease appear to be less infective. However, one mouse which was infective after a 48-hour incubation period was also infective about two days later, a few hours before it died of the disease.

74. *Morphological Variations of Trophozoites of* Endamoeba histolytica *as Affected by Temperature and Cultivation and its Practical Bearing in Diagnosis.* H. Tsuchiya, Washington University.

Since the morphology of the nucleus of *Endamoeba histolytica* is generally considered as an important criterion in diagnosis, the nuclei of trophozoites from the stools of acute amebic dysentery were tentatively classified into those diagnostically acceptable ones and those that were not. The classification was made on the basis of the type of karyosome with respect to size and position, the type of peripheral chromatin granules as to thickness and arrangement, and the presence and absence of chromatin granules within the nuclear interspace. An attempt was then made to determine just how long a stool sample may be left at room temperature without losing the characteristic morphology of the organisms for definite identification. It was found that while trophozoites of *Endamoeba histolytica* in freshly voided stools possessed a very high percentage of acceptable nuclei, exposure up to three hours and, in a few instances, to five hours, did not seem to lessen the diagnostic value. The morphology of cultural amebas remained fairly constant with a probable exception in the coarseness of the peripheral chromatin granules. Any difficulty in identification may be eliminated by the use of a selective medium for the organisms such as utilized in this experiment.

75. *The Diagnosis of Taeniasis by Perianal Swab.* Alan C. Pipkin, American University, Beirut, Lebanon.

Examination on four successive occasions by N.I.H. swab, of 127 Lebanese children in a village school of the Mount Lebanon area near Beirut, disclosed that 90 per cent harbored *Taenia* species tapeworms, undoubtedly *Taenia saginata,* since many beef tapes were subsequently recovered from them on treatment. Fifty-seven out of 60, or 95.0 per cent of the boys, and 57 out of 67, or 85.1 per cent of the girls were so infected, as based on four swab examinations. Among the same group, 96.1 per cent had pinworms. A breakdown of this data to sexes showed that 93.3 per cent of the boys and 98.5 per cent of the girls harbored *Enterobius vermicularis.* A single zinc sulfate stool concentrate revealed only 22 or 19.3 per cent of the 114 cases shown by anal swabs to harbor beef tapeworms. The same stool examination uncovered only 6 or 4.9 per cent of the 122 cases shown by anal swabs to be infected with pinworms. The percentages of cases uncovered by a single cellophane swab was approximately 70.0 per cent and 66.0 per cent for *Taenia* and *Enterobius* eggs, respectively. Assuming that 100 per cent of the children were infected with beef tapeworms and pinworms, and this is not unlikely, it is apparent that the perianal swab is quite as efficient a method of diagnosis for *Taenia saginata* as for *Enterobius vermicularis.*

76. *An Intensive Treatment Regimen of Vesical Schistosomiasis with Fuadin.* Joseph E. Azar, Alan C. Pipkin, and G. A. Garabedian, American University, Beirut, Lebanon.

In an attempt to develop a therapeutic regimen suited for rapid mass administration to unhospitalized ambulatory cases of schistosomiasis haematobium, Fuadin was given intramuscularly in an intensive course to 55 Syrian villagers; 38 school boys, 9 to 14 years of age, and 17 adult males, 20 to 40 years of age. The total adult dose of 34 cc of a 6.3 per cent solution of the drug was given in nine injections, one every three hours daily, over a three day period. One half of this total dose was given to the school boys at similar intervals over the same period. Reaction to the drug consisted mainly of muscular soreness at the site of injection in the buttocks. Transitory constitutional reactions developed in a few of the adults, but in no case were the toxic manifestations severe enough to warrant discontinuance of treatment. Follow-up studies were made for a five-day period immediately following treatment, and again for a similar period two weeks later. Temporary cessation of egg production in roughly 50 per cent of the cases during the

last three days of the second observation period, and complete cessation of hatching of motile miracidia in from 60 to 70 per cent of the cases for the last four days of this same period seems to constitute evidence of definite improvement. In view of the apparent lack of toxicity of Fuadin when given under the intensive regimen, its further trial under similar conditions seems indicated.

77. *Treatment of Taeniasis Saginata with Atabrine.* Alan C. Pipkin and Emile Rizk, American University, Beirut, Lebanon.

Attracted by the favorable reports of Drs. Neghme and Feiguenbaum in Chile on the treatment of *Taenia saginata* infections with atabrine, a similar treatment was tried on 42 Lebanese school children, 4 to 19 years of age, who were known to harbor this worm. Although it was not possible to control their diet rigidly, they were instructed to eat little the day before treatment, taking perhaps an apple and as much milk as desired, and nothing at all the night before or the morning of treatment. The total dosage of the drug varied between 0.5 and 1.0 gm (5 to 10 tablets of 0.1 gm each) depending on the age and body weight, and it was administered in two doses an hour apart. Three hours after the second dose, during which period the patient rested, a heavy saline purge (magnesium or sodium sulfate) or emulsified castor oil was given orally. Seven, or 16.6 per cent passed complete strobilae, one case of which passed four entire worms. Eight others passed chains of 10 to 50 segments, but no scolices. While the treatment, even when given under admittedly unfavorable conditions of diet control, showed some promise as far as the cases receiving heavier doses were concerned, the toxic manifestations accompanying the regimen warranted its discontinuance. All cases complained of nausea and headache, nearly half of them vomited some, and two cases vomited violently and repeatedly. It was concluded that the regimen is unsuited for unhospitalized patients.

78. *Parasites of the Ranidae (Amphibia). XI.* A. C. Walton, Knox College.

The annotated catalog of the parasites of the genus *Rana* continues the list of hosts and their parasites as follows:—47. *Rana güntheri* (China)—larval *Pharyngostomum cordatum* (Trematoda); and *Dactylosoma ranarum, D. splendens, Trypanosoma borrelli, T. rotatorium,* and *T.* spp? of Mathis & Leger, 1911, and of Laveran & Mesnil, 1912 (Protozoa). 48a. *R. hexadactyla* (Burma-India-Ceylon)—*Spironoura brevispiculata* (Nematoda); *Ganeo glottoides, Haematoloechus capyristes, Halipegus longispina,* and *Pleurogenes sphaericus* (Trematoda); *Balantidium gracile, B. helenae, Haemogregarina berestnieffi, Lankesterella minima, Nyctotherus macropharyngeus, N. magnus, Opalina japonica, O. lata, Trypanosoma inopinatum, T.* spp? of Dobell, 1910, and of Laveran & Mesnil, 1912 (Protozoa); and *Hemiclepsis viridis* (Hirudinea). 48b. *R. hexadactyla* (Zool. Gard., Europe)—*Camallanus nigrescens* (Nematoda). 49. *R. holsti* (Japan)—*Haementeria okadai* (Hirudinea). 50. *R. jerboa* (Java)— *Opalina* sp? of Metcalf, 1940 (Protozoa). 51. *R. labialis* (Siam)—*Opalina malaysiae* (Protozoa). 52a. *R. limnocharis* (S. E. Asia)— *Amphibiophilus acanthocirratus,* larval *A.* sp? of Hsü & Hoeppli, 1933, and "Microfilariae" of Mathis & Leger, 1912 (Nematoda); larval *Centrocestus formosanus, Diplodiscus amphichrus, D. japonicus,* larval *Encyclometra asymmetrica,* and larval *Pharyngostomum cordatum* (Trematoda); *Balantidium helenae, B.* sp? of Metcalf, 1923, *Cepedea longa, C. longa ?hispanica. Dactylosoma ranarum, D. splendens, Haemogregarina berestnieffi, H. scheini, H.* spp? of Berestnev, 1902, of França, 1917, of Houdemer, 1927, and of Mathis & Leger, 1911, *Lankesterella minima, Nyctotherus ?cordiformis, N. macropharyngeus, N. nankingensis, N. pyriformis, Opalina acuminata, O. japonica, O. lata, O. undulata, Protoopalina limnocharis, Trypanosoma borrelli, T. rotatorium,* and *T.* spp? of Laveran & Mesnil, 1912, and of Mathis & Leger, 1911 (Protozoa); and *Kiricephalus pattoni* (Porocephalida).

79. *Parasites of the Ranidae (Amphibia). XII.* A. C. Walton, Knox College.

52b. *R. limnocharis* (Japan)—*Icosiella kobayasii* (Nematoda). 52c. *R. limnocharis* (Java)—*Oxysomatium* sp? of Walton, 1933 (Nematoda). 53. *R. luzonensis* (Philippines)—*Cepedea luzonensis* (Protozoa). 54. *R. macrocnemis* (Europe)—*Oswaldacruzia filiformis, Oxyuris tba, "O."* sp? of Dinnik, 1926, and *Rhabdias bufonis* (Nematoda); *Gorgoderina vitelliloba, Haplometra cylindracea, Opisthodiscus subclavatus* (metacercariae in tadpoles), and *Polystoma integerrimum* (Trematoda); and larval *Acanthocephalus* sp? of Dinnik, 1926 (Acanthocephala). 55. *R. macrodactyla* (Malaya)—*Opalina nucleolata siamensis* (Protozoa). 56a. *R. macrodon* (Philippines)—*Physaloptera amphibia* (Nematoda). 56b. *R. macrodon* (S. E. Asia)—*Opalina nucleolata siamensis,* and *Protoopalina quadrinucleata* (Protozoa). 56c. *R. macrodon* (Zool. Gard., Eng.)—"Microfilariae" of Wenyon, 1931 (Nematoda); and *Haemogregarina* sp? of Wenyon, 1931, and *Trypanosoma* sp? of Scott, 1926 (Protozoa). 57. *R. maculata* (Europe)—*Haematoloechus variegatus* (Trematoda). 58. *R. magna* (Philippines)— *Oxysomatium ranae* (Nematoda); larval *Clinostomum pseudoheterostomum* (Trematoda); and *Cepedea luzonensis aponensis* (Protozoa).

59. *R. malabarica* (India)—*Nyctotherus ?cordiformis,* and *Opalina lata cordata* (Protozoa). 60a. *R. mascareniensis* (Africa)—*Amphibiophilus acanthocirratus, Aplectana acuminata,* and larval *Physaloptera* sp? of Loveridge, 1936 (Nematoda); *Lepoderma ramlianum,* and *Mesocoelium monadi* (Trematoda); *Baerietta jägerskiöldi,* and *Nematotaenia dispar* (Cestoda); and *Balantidium* sp? of Metcalf, 1923, *Haemogregarina neireti, H. pestanae, H.* sp? of Schwetz, 1938, *Opalina* sp? of Metcalf, 1923, *Toddia* sp? of França, 1917, and *Trypanosoma* spp? of Dutton, 1907, and of Laveran & Mesnil, 1912 (Protozoa). 60b. *R. mascareniensis* (Mauritius)—*Lepoderma monplei* (Trematoda).

80. *Parasites of the Ranidae (Amphibia). XIII.* A. C. Walton, Knox College.

61. *R. montezumae* (Mexico)—*Dibulbiger longispiculata, Foleyellides striatus,* and *Spiroxys corti* (Nematoda); *Cephalogonimus robustus, Glypthelmins californiensis, Gorgoderina attenuata, Haematoloechus coloradensis, H. complexus, H. elongatus, H. illimis, H. macrorchis, H. medioplexus, H. parvivitellarius, H. varioplexus, Halipegus lernensis,* and *Megalodiscus temperatus* (Trematoda); and *Trichomonas augusta* (Protozoa). 62. *R. mugiens?* (Annam)—larval *Diphyllobothrium erinacei* (Cestoda). 63. *R. muta?* (Europe)—*Acanthocephalus ranae* (Acanthcephala). 64. *R. namieyi* (Japan)—*Haementeria okadai* (Hirudinea). 65a. *R. nigromaculata* (China-India-Manchoukuo)—*Rhabdias incerta,* and *Spiroxys japonica* (Nematoda); *Diplodiscus amphichrus, Diplorchis nigromaculatus, Haematoloechus jeholensis* n. comb.(=*Pneumonoeces jeholensis* Fukui & Ogata, 1938), *H. lobatus* n. comb. (=*P. lobatus* Seno, 1907), and *H. tientsinensis* (Trematoda); larval *Diphyllobothrium erinacei* (Cestoda); *Acanthocephalus sinensis* (Acanthocephala); and *Balantidium giganteum, B. rotundum, B.* sp? of Metcalf, 1923, *Cepedea dimidiata orientalis, C. lanceolata, Opalina ranarum, O.* sp? of Bezzenberger, 1903, and *Protoopalina axonucleata lata* (Protozoa). 65b. *R. nigromaculata* (Japan)—*Amphibiophilus socialis, Cosmocerca japonica, Hedruris ijimae, Oswaldocruzia bialata, Rhabdias bufonis, R. nipponica, Spinitectus ranae,* and *Spiroxys japonica* (Nematoda); *Diplodiscus japonicus, Diplorchis nigromaculatus,* larval *Echinochasmus elongatus,* larval *Echinostoma cinetorchis* and *E. macrorchis,* larval *Encyclometra japonica, Glypthelmins rugocaudata, Gorgodera japonica, Haematoloechus nanchingensis, H. sibericus japonicus, H.* spp? n. comb (=*Pneumonoeces* spp? of Kobayashi, 1921, and of Matuda, 1938), *Halipegus japonicus, Loxogenes liberum, Mesocoelium brevicaecum, M. elongatum, Opisthodiscus subclavatus, Pleurogenes japonicus, Polystoma ozakii,* and larval *Proalarioides serpentes* (Trematoda); larval *Diphyllobothrium latum?, Ophiotaenia ranae, O. ranarum,* and *O.* sp? of Matuda, 1938 (Cestoda); *Acanthocephalus lucidus,* and larval *Arhythmorhynchus hispidus* (Acanthocephala); and *Protoopalina hexasoma* (Protozoa). 66. *R. nigro, chosenica* (Korea)—*Diplodiscus amphichrus* (Trematoda).

81. *Comparative Fertility of Strongylid Eggs Passed by Horses.* A. C. Todd and M. F. Hansen, Kentucky Agricultural Experiment Station.

In a survey of the development of worm infections in thoroughbreds at 6 different nurseries in Central Kentucky, horses at one stud have been found to pass a significantly greater percentage of infertile strongylid eggs. At this stud an effort is being made to control strongyles by a system of periodic low-level phenothiazine administration. The cycle of treatment consists of 2 weeks of daily administration of 2 grams of phenothiazine powder in the feed, followed by a week when none of the drug is given. Egg counts are obtained at weekly intervals for 10 mares and their foals at the one stud and also for approximately 30 mares and their foals at the other 5 nurseries.

In a 7-week period, a total of 503 strongylid eggs were observed in fecal samples from the above stud. Of this number, 348 (69.2 per cent) were infertile. The percentage of infertile eggs in the weekly samples has ranged from 51.8 to 78.5. In the same period, a total of 5,820 strongylid eggs were observed in counts of the other horses and of this number 228 (3.9 per cent) were infertile. The percentage of infertile eggs in the weekly counts for these latter horses has ranged from 2.1 to 6.4.

82. Eimeria tenella *Infection in Chickens with Induced Mild Hyperthyrosis.* A. C. Todd and M. F. Hansen, Kentucky Agricultural Experiment Station.

The amount of growth made in a 23-day test period by 30 New Hampshire broilers directly exposed to infective oöcysts of *E. tenella,* and which were fed a standard starting and growing ration, was compared with the amount of growth made in the same test period by 30 other New Hampshire broilers, also directly exposed to *E. tenella,* but which were fed the basal ration containing 0.04 thyroprotein. All the birds were 50 days old when exposed to infection and were 73 days old when the experiment was terminated. The mean oöcyst count per gram of cecal contents at the conclusion of the test period was determined for each lot.

The mean weight gain of birds fed the basal ration was 337.7 grams; the mean weight gain of birds fed thyroprotein was 350.4 grams. The 12.7 gram greater mean gain of birds fed thyroprotein was not statistically significant.

The mean oöcyst count per gram of cecal contents of birds fed basal ration at 23 days after exposure was 49,485; the mean count of thyroprotein birds 23 days after exposure was 575,255. The number of oöcysts given in the experimental infections was 250 ±. The difference in oöcyst counts in the two groups of birds was found to be highly significant upon statistical analysis.

83. *Inter-generic Crosses Among Schistosomes (Trematoda: Schistosomatidae).* Robert B. Short, University of Michigan.

Six white mice and six laboratory-reared *Peromyscus maniculatus* were each infected with male *Schistosomatium douthitti* and female *Schistosoma mansoni,* using cercariae of known sex derived from snails infected with single miracidia. At autopsy 36–107 days after exposure, 400 male *Schistosomatium* and 318 undersized female *Schistosoma mansoni* were recovered, including 130 pairs *in copula,* plus five males each clasping two females. *Schistosoma mansoni* eggs, some mal-formed, others of typical shape, were seen in tissues of seven mice with female worms 50–107, and males 36–107 days old. Embryos and mature, living miracidia were present in a few eggs from two of these seven hosts with females 81 and 107, and males 82 and 107 days old respectively. No eggs were found in 30–90 day-old control infections with female *S. mansoni* alone.

Four additional laboratory-reared *P. maniculatus* and two white mice were infected with male *S. mansoni* and female *S. douthitti.* From these six animals 29 pairs *in copula* and many separate worms of both sexes were recovered. Host tissues contained many *S. douthitti* eggs, some with mature, living miracidia.

It has been shown (Short, Jour. Parasitol. Suppl., *33:* 9, 1947) that female *S. douthitti,* in the absence of males, mature and lay eggs in which miracidia develop. It is of interest, however, that the influence of male *S. douthitti,* although not necessary for the maturity of female *S. douthitti,* can bring the females of another genus (*Schistosoma*) to sexual maturity.

84. *Infective Uniparental Miracidia of* Schistosomatium douthitti *(Trematoda: Schistosomatidae).* Robert B. Short, University of Michigan.

Miracidia from the livers and feces of deer mice (*Peromyscus maniculatus*) infected with female *Schistosomatium douthitti* only were used to expose 373 young laboratory-reared snails 285 *Lymnea palustris* and 88 *L. stagnalis*). Some snails were exposed to a single miracidium each; others were exposed in groups to many miracidia. After a period of several weeks, cercariae emerged from two of the 231 surviving *L. palustris* and from three of the 76 surviving *L. stagnalis.* Mice infected with cercariae from four snails yielded only male worms; those mice infected with cercariae from the remaining snail yielded only females. The worms thus derived appear to be normal *S. douthitti,* and living miracidia were found in a few eggs laid by the females in unisexual infections. Cytological studies are in progress.

85. *Preliminary Drug Trials to Determine Anthelmintic Activity Against* Trichocephalus vulpis *in Dogs.* J. C. Swartzwelder and H. E. Wicker, Louisiana State University.

Attempts have been made to test certain anthelmintics for possible activity against *T. vulpis* in dogs, in order that similar drugs or analogues of any showing moderate effectiveness might be explored. Drugs suitable for parenteral administration were tested as well as compounds given orally. Egg counts before, during and after treatment and examination of total excreta for adult worms during and for at least a week after therapy were employed to evaluate anthelmintic activity. Particularly for light infections, a brine flotation and filtration technic for isolating ova from a sample of feces proved to be the most satisfactory method for following egg output. Dogs with natural or induced infections were used. Drugs tested included gentian violet, acranil, acriflavine, phenothiazine, Stovarsol, Disparicida Kuba, emetine hydrochloride powder orally, emetine hydrochloride intramuscularly, fuadin intramuscularly and arecoline hydrobromide orally. In most cases per kilo dosage was based upon apparently tolerated dosage for humans. Low dosage appeared preferable to minimize "therapeutic" effect through bowel irritation rather than from anthelmintic activity. Activity of the anthelmintics employed was apparent only in effect on egg output. The only drugs tested which apparently produced significant reduction in egg counts were arecoline hydrobromide, Disparicida Kuba and gentian violet. Arecoline gave the most consistent reduction. The latter drug produced irritation of the bowel in the doses usually prescribed. Spontaneous loss of parasites, variation in egg output and frequent location of adult worms in the cecal diverticulum are factors which limit the value of this host as a test animal.

86. *The Effect of a Blacktongue Producing Diet on Experimental Amoebiasis in Dogs.* JOHN E. LARSH, JR., University of North Carolina.

Ten mongrel adult dogs were used in the first experiment. These were kept in the laboratory for two months prior to use to allow ample time for improvement of their nutritional status. They were then matched according to sex and approximate weight. All of them were fed a modification of Goldberger's diet, known to be especially deficient in nicotinic acid. One-half of the group served as controls which were given by mouth 10 mgm of nicotinic acid weekly. When an experimental animal showed the first sign of blacktongue, slight reddening of the oral mucosa, it and its control were infected with 24 hour cultures of a human strain of *E. histolytica.* The culture sediment, containing mostly trophozoites, was given orally in salol-coated gelatin capsules, shown by prior trial to open in the lower ileum. The animals were maintained on their respective diets. The experimental dogs were given minimal amounts of nicotinic acid to prevent exacerbation of the blacktongue symptoms. Daily rectal samples were taken from the infected animals by use of a long glass tube (Faust). This material was examined directly and placed in culture. The various animals were killed at different times after infection depending upon the physical condition of the experimental dog.

A much larger percentage of the experimental animals became infected and the amoebae were demonstrated sooner. It is interesting that in one experimental dog showing amoebae, the rectal samples remained negative for a short time after nicotinic acid was given. At autopsy the experimental dogs showed a greater number of ulcers. These showed no fuso-spirochaetal organisms, but most of them revealed amoebae on direct examination or following culture. No liver abscesses were detected. The experiment is being repeated.

87. *The Role of Certain Vitamins in Alcoholic Debilitation of Mice Infected With* Hymenolepis. JOHN E. LARSH, JR., University of North Carolina.

Earlier work has shown that polyvitamin (Abbott) injections prevent the lowering of resistance to this parasite brought about by alcohol treatment. In an initial attempt to demonstrate the particular vitamin(s) involved, the following tests were made.

Young mice, six weeks old, were divided into five groups and received the following: (1) alcohol without vitamin supplements, (2) alcohol with polyvitamin supplements, (3) alcohol with B-complex supplements, (4) alcohol with vitamin A, C, and D supplements, and (5) non-alcoholic controls without vitamin supplements. After three weeks of daily treatment, during which the mice of groups 1–4 received the same amount of alcohol, all of the animals were infected with *Hymenolepis.*

As previously demonstrated, the mice of group 1 showed a striking lowered resistance as compared with the controls (group 5), but the resistance of the mice of group 2 was not lowered. The mice of group 3 had about the same number of parasites as those of group 1 showing that vitamin B supplements had no effect in preventing alcoholic debilitation. However, the mice of group 4, supplemented with vitamins ACD, had significantly fewer parasites than those of groups 1 and 3, showing that one or more of these vitamins prevented the lowering of resistance. In considering the nutritional demands of this host, and on the basis of results from related studies, it is most likely that this effect was due to the action of vitamin A. This problem is being studied further.

88. *Comparing the Immune Response of Young and Old Mice to Infections With 50 and 300 Larvae* of Trichinella spiralis. JAMES R. HENDRICKS, University of North Carolina.

In the various tests, young mice (two months old) were matched in groups of four with old mice (nine months old). Seven days after a single infection with 50 larvae, the young mice showed an average of 57.0 per cent development of adult worms, compared with 28.4 per cent for the old mice. On the other hand, following a single infection with 300 larvae, there was little difference in the percentage development, 32.4 and 26.8, respectively. This suggests that failure to note age resistance in previous work may have been due to size of infecting dose.

In experiments in which the mice were given a second infection of the same size after 30 days, the percentages of development of adults were similar. For the dose of 50 larvae, the percentages for the young and old mice were 26.0 and 24.0, respectively. Results following the dose of 300 larvae were 35.0 and 25.6 per cent, respectively. Thus in both cases the old mice showed about the same percentage development as following one infection, but the young mice after reinfection with 50 larvae showed a reduction of more than 50 per cent in the number of adults recovered. In previous studies it had not been possible to demonstrate immunity to one infection (300 larvae) in young mice. The above results suggest that this was due to size of infecting dose.

Various dosages of larvae are being used in an attempt to determine the quantitative rela-

tionship between size of infecting dose and the degree of immunity shown by mice of the two age groups.

89. *Tissue Phase of* Ascaridia galli *Life Cycle Elucidated by Artificial Digestion Apparatus.* J. E. Ackert and R. L. Tugwell, Kansas State College.

The parasitic habitat of *Ascaridia galli* was reported by Ackert (1923) to include the wall of the small intestine as well as its lumen. By making micro-sections he concluded (1931) that the young worms bury their anterior ends in the intestinal mucosa from the 10th to the 17th day of parasitism after which they withdraw into the lumen.

By digesting the small intestines of parasitized chickens following flushing of the entrails for free *Ascaridia galli,* the present workers have found that the young worms may penetrate the mucosa as early as the third day of parasitism and may remain in it up to the 24th day. The combination of flushing and digesting the intestines of parasitized fowls gives promise of bringing to light other significant findings.

90. *The Morphology of* Urceolaria karyolobia *sp. nov.,* Trichodina tegula *sp. nov., and* Scyphidia ubiquita *sp. nov. from Southern California Limpets and Turbans.* Henry I. Hirshfield, University of Missouri.

Three new species of peritrichous ciliates found within the mantle cavities of Southern California limpets and turbans are proposed: *Urceolaria* (*Leiotrocha*) *karyolobia, Trichodina* (*Cyclochaeta*) *tegula,* and *Scyphidia* (*Gerda*) *ubiquita,* spp. nov. The first two of the newly proposed species are in the family Urceolariidae, the latter in the family Scyphidiidae.

The morphology of the three species agrees substantially with existing generic descriptions. The life cycle of these three species does not differ from other members of the same genera.

An explanation for the arrangement of the radial plates and pins in members of the family Urceolariidae is offered. The pins are proposed as being compound structures, within which lies the "dental" plate.

Taxonomic status of several previously described species of the family Urceolariidae is questioned, and classification problems within the family are discussed.

91. *AEX and "Faust Simplificado" (Bonilla-Naar), Two New Methods for Investigating Intestinal Parasitism.* Alfonso Bonilla-Naar and Miguel Gomez-Vargas, Facultad Nacional de Medicina, Bogota, Colombia.

The authors tested in parallel five technics on 100 routine fecal specimens at San Juan de Dios Hospital, Bogota. The AEX modification of the Telemann (described by Loughlin and Stoll, 1946), demonstrated the highest number of positives for hookworm, whipworm, infertile and fertile ascaris ova and *S. stercoralis* larvae. It's concentration of protozoan cysts (*E. histolytica, E. coli, I. bütschlii,* and *Giardia*) compared favorably with the modified "Faust Simplificado" (below), but it is not recommended for protozoan diagnosis on account of cyst deformation. The Faust technic (modified by comminuting directly in zinc sulphate at 1.180 sp. gr., a simplification we advise) was inferior to AEX and the Willis-Molloy in revealing helminth positives, especially of whipworm. The zinc sulphate technic is therefore less recommendable for egg diagnosis, but is the method of election for cyst diagnosis. The Willis-Molloy salt flotation produced fewer positives of the egg-bearing nematode infections than either AEX or "Faust Simplificado" (but had rich egg yields when they were present), and was, as is known, useless for protozoan cysts. From the diagnostic point of view Stoll's dilution egg counting method showed fewer positive cases, indicating light infections were principally being encountered. The egg count positives revealed 1½ to 4 times the number of eggs per gram found by AEX. Direct smears (in saline, with Lugol's iodine staining) demonstrated in our hands 50 to 70 per cent of the nematode infections, 43 per cent of the *E. histolytica* cyst positives and 83 per cent of the *Giardia* positives.

92. *Culture Experiments with* Heterodera marioni. M. S. Ferguson, Rockefeller Institute for Medical Research, Princeton, New Jersey.

It has been possible to rear the root-knot nematode, *Heterodera marioni,* through its complete life cycle in plant and root cultures free from microörganisms.

Tomato seeds treated with sodium hypochlorite and washed in sterile water were transferred into large test tubes containing slants of a semi-solid medium developed for the cultivation of excised roots and plant tumor tissue. Upon germination of the seeds, eggs of *H. marioni* recovered from infected tomato roots and freed from microörganisms by treatment with sodium hypochlorite were introduced into the culture tubes. In some experiments the primary roots, when only three millimeters long, were separated from the cotyledons and the latter re-

moved from the tubes before axenic nematode eggs were added to the cultures. The culture tubes were sealed with parafilm to prevent evaporation. The seedling plants and excised roots grew rapidly and the root tissues were invaded by many of the nematode larvae hatching from the axenic eggs.

Within about six weeks the life cycle of *H. marioni* was completed in both the plant and root cultures. Large egg masses were deposited by the females embedded in the root tissues and the characteristic swellings or knots were produced on the roots. By serial transfers the nematode was carried through four generations in the plant cultures. As far as could be determined, development of *H. marioni* in the cultures was similar to that in roots infected under natural conditions in the soil.

93. Moniezia expansa *Infections in Sheep.* PHILIP A. HAWKINS, Michigan State College.

Studies have been carried on during the past several years with naturally acquired parasitic infections in sheep under flock conditions. It was noted that in these groups of non-medicated animals the eggs and proglottids of *Moniezia expansa* appeared in the droppings 25 to 35 days after the lambs were placed on pasture in late May. This was observed for five consecutive years, indicating a consistent overwintering of the infection in the oribatid mites from October until the following May or June, despite the severity of the weather conditions. Whether or not this carryover was for more than one winter, as noted by some investigators, could not be determined in this work. In the late spring of 1948 the flock was placed on a pasture not previously used for sheep. Fecal examination of the ewes at this time revealed a few with a light tapeworm infection, but the lambs were not infected and remained free of infection until August 27. In pastured lambs it may be expected that early infections result from contamination of the pasture during the previous grazing season, with the resultant winter carryover in the intermediate host. Infections during the latter part of the summer are probably the result of contamination of the pasture with a new infection during the late spring and early summer grazing seasons.

94. *Seasonal Studies on* Oncomelania nosophora *and the Control of* Schistosoma japonicum *in Japan.* DONALD B. MCMULLEN, 406th Medical General Laboratory.

If schistosomiasis japonica is to be controlled by the use of molluscicides it is important to determine the optimal periods for application. From August 1947 to September 1948 observations were made in Yamanashi Prefecture, Japan. It has been found that there are two periods during the year when the chemicals now available can be used. One is after the snails come out of hibernation and before the ditches are used for irrigation. This extends from about 1 April to 15 May–1 June. The other period begins after the water is turned out of the irrigation ditches, 25 September–1 October, and lasts until hibernation 1–10 November. During these periods the snails move about actively on a moist soil habitat and are susceptible to chemicals applied as dusts or sprays.

95. *Results of Screening Tests on Chemicals as Molluscicides.* DONALD B. MCMULLEN, 406th Medical General Laboratory; N. ISHII AND Y. MITOMA, National Institute of Health, Japan.

In laboratory and field tests 32 compounds and mixtures have been tested for toxicity for *Oncomelania nosophora,* the intermediate host of *S. japonicum* in Japan. Laboratory tests indicated that the following chemicals were of little value: benzene hexachloride (isomer unknown), Lethane 60, chloronitro-biphenyl, copper phosphate, tribasic copper sulphate, DDT dust, Rothane, Lethane A-70, Honspalter, methoxychlor DDT dust, "raw" naphthalene, naphthalene "extract," pine root oil, chlorinated pine root oil, Krenite, Cryolite, and tetraethyl pyrophosphate. The following chemicals showed some promise in the laboratory and were given field tests: gama benzene hexachloride, Lethane 384, Chlordane, chlorinated camphene, dinitrochlorobenzene, DDT emulsion, He-761, "lime nitrogen," methoxychlor DDT emulsion, and pentachlorophenol. The chemicals most toxic to the snails were: sodium pentachlorophenate, dinitro-o-cyclohexylphenol, its dicyclohexylamine salt, and proprietary mixtures of the last two chemicals. The ditches used in the tests measured 2–3 ft in width. Fifty grams of the chemicals per 100 ft of ditch gave excellent control of the snails.

96. *Seasonal Studies of* Schistosoma japonicum *Infections in the Intermediate Host,* Oncomelania nosophora. DONALD B. MCMULLEN, 406th Medical General Laboratory, with the Technical Assistance of T. ENDO, P. R. STONE, S. SETO, AND M. KAMIYAMA.

During the period from October 1947 through September 1948 about 500 *O. nosophora* were collected each month from each of four collecting stations in Yamanashi Prefecture and examined

for *S. japonicum* infections. The approximate age of each infection was recorded as the number of weeks necessary to reach the stage observed under optimum conditions. During this study 27,746 snails were examined and 738 infections were seen. In October, just before the snails began to hibernate, only immature and young mature infections were observed. A few became mature by November and then the relationship remained about the same until April, shortly after the snails came out of hibernation. At this time the number of mature infections increased. During June and July, when the rice was being planted and cultivated, there were numerous mature infections. The average per cent of infection from October through May was 1.7, ranging from 1.1 to 2.6. In June and July a large number of the snails acquired infections. In the July collection the average per cent was 3.6 and in August it was 6.0. In the July collection 78.6 per cent of the 84 infections seen were six weeks old or less. In August only 18.6 per cent of the 218 infections were immature. On 15 September the rate had dropped to 2.3 per cent and 7.5 per cent of the 53 infections were immature. Cercarial production reached a peak during the period when people work in the rice fields in the early summer. An even greater number of cercariae were produced late in August and early September. Fortunately work in the fields was at a minimum during this period but the water in the area was highly infectious. The snails probably acquired a few infections at any time they were active. Most infections, however, were acquired in June and early July, and in late September and October. The infections from the first period had almost disappeared by mid-September. The infections from the second period hibernated with the snails and disappeared in July.

97. *Studies on Epidemic Amebiasis Occurring in Occupants of the Mantetsu Apartment Building, Tokyo, Japan.* I. *Parasitological Findings and Epidemiological Aspects.* L. S. RITCHIE, 406th Medical General Laboratory, AND C. D. DAVIS, 385th Medical General Dispensary.

During early January 1947, numerous cases of diarrhea occurred among occupation families billeted in the Mantetsu Apartments, located in downtown Tokyo. Thorough investigations were started when initial stool examinations on 16 occupants revealed a total of 39 protozoan infections. Americans residing in the building included 143 adults and five children, and 8 assigned Army personnel. Infection rates (excluding children) were *E. histolytica,* 62.9; *E. coli,* 27.8; *E. nana,* 59.0; *G. lamblia,* 76.2; and *C. mesnili,* 10.6 per cent.

Examination of 248 Japanese employees indicated that they as as a group had also been exposed, but to a lesser degree. Infection rates for the Japanese were: *E. histolytica,* 22.2; *E. coli,* 34.3; *E. nana,* 29.0; *G. lamblia,* 46.0; and *C. mesnili,* 5.7 per cent. These were at least twice the expected rate.

Exposure apparently occurred largely during the first week of January and the epidemic was recognized January 23. Its recognition was seemingly due to clinical manifestations resulting largely from some causative agency other than *E. histolytica.* There was no evidence that food-handlers in the building's central mess, where all of the occupants ate, were responsible for the epidemic. Of all the Japanese employed in the building, only the food-handlers received left over foods from the mess, yet the non food-handlers were equally infected.

Circumstances indicated that leakage from a sewage tank in a dark, dank, sub-basement area had accumulated in sufficient quantities to at least partially submerge the continguous primary water main. A leaking water meter in the threatened portion of the main, combined with the action of two booster pumps in producing negative pressures, furnished all the necessary conditions for water pollution.

98. *Parasitological Studies on the Far East. II. An Epidemiological Survey of Fukui Prefecture, Honshu, Japan.* G. W. HUNTER, III, L. S. RITCHIE, K. NAGANO, AND N. ISHII, with the Technical Assistance of R. MIRAKUNI, R. E. WEBER, J.T. SZEWCZAK AND S.ASAKURA, 406th Medical General Laboratory and National Institute of Health of Japan.

In August 1947 a series of epidemiological surveys was begun to secure data on incidence and density of helminthic and protozoan infections among the Japanese.

Twelve hundred and thirteen, or 93.6%, of 1296 persons examined from Fukui Prefecture harbored parasites. Eleven hundred and sixty four, or 89.8%, carried worms while 626 or 48.3% were infected by protozoa. *Ascaris, Trichuris,* hookworm and *Trichostrongylus* were present respectively in 80.9, 63.7, 12.9 and 3.5% of cases. These rates were low compared with findings in some other areas in Japan.

Among the protozoa *Endamoeba histolytica* was encountered in 11.3%, *E. coli* in 29.2%, *E. nana* in 20.3%, *Chilomastix mesnili* in 8.9%, *Giardia lamblia* in 8.4%, and *Iodamoeba butschlii* in only 2.6% of the individuals examined. A high of 19.2% *E. histolytica* was detected in one village where the paddies were on terraces situated above the village. The streams used as a

source of water were subject to contamination by the run off from these paddies during heavy rains.

A diligent search was made for schistosomiasis but none was found in the Fukui population. *Oncomelania nosophora* was absent and other potential snail hosts were not capable of supporting an experimental infection of *S. japonicum.*

In these surveys each individual was given a brief physical examination by the same group of doctors. the stool specimen was prepared and examined by the same group of technicians using the MGL and AMS III technics. In this way variables were largely eliminated and the results of one area should be comparable with those secured from another.

99. *Parasitological Studies in the Far East. III. An Epidemiological Survey of Aomori Prefecture, Honshu, Japan.* L. S. Ritchie, G. W. Hunter, III, C. Pan, J. T. Szewczak and N. Ishii, with the technical assistance of S. Izumi, R. E. Weber, Y. Hishinuma, and S. Asakura, 406th Medical General Laboratory and the National Institute of Health of Japan.

Aomori, the northern-most prefecture of Honshu, Japan, was surveyed during October and November 1947. Four population centers, including Aomori City and rural villages contiguous with Ominato, Hirosaki and Hachinoe were examined. Of 1548 individuals, 94.8% were parasitized; 92.1% were infected with helminths and 45.3% with protozoa. Ascaris infections were found in 80.9% of the people examined. The lowest rates of ascariasis (63.2%) existed at Hachinoe in contrast with 87.8% at Ominato. The whipworm prevalency surpassed that of ascaris at Ominato, 91.5 as compared with 87.8%. Although the whipworm survey average was 63.4% a low incidence of 23.8% occurred at Hachinoe. The hookworm rate in one village near Hirosaki was 66.8%, and in a second where 121 children only were examined, the rate was 82.6%; the survey average was 38.4%. The pinworm incidence for 209 children by means of the Graham Scotch tape swab was 10.0%.

The incidence of *E. histolytica* was 7.4%; a high rate, 14.1%, was found at Ominato in contrast to 3.0 at Hirosaki. Correspondingly high and low rates for *E. coli* was 31.0 and *E. nana* 17.3%. Incidence for *G. lamblia* and *C. mesnili* were 6.8 and 5.0%.

Considerable variations in parasitemia occurred in the rural communities. Infection rates for most helminths and protozoa in Aomori City were essentially the average of the rural areas.

100. *Parasitological Studies in the Far East. IV. An Epidemiological Survey in Yamanashi Prefecture, Honshu, Japan.* G. W. Hunter, III, L. S. Ritchie, E. H. Kaufman, C. Pan, J. T. Szewczak, M. Yokogawa, and N. Ishii, with the technical assistance of R. E. Weber, F. Williams, Jr., S. Asakura, and Y. Hishinuma, 406th Medical General Laboratory and National Institute of Health of Japan.

A survey of intestinal parasites was begun in Yamanashi Prefecture, Honshu, Japan, during December 1947 and was completed in February 1948. This prefectural area is of singular interest because it includes the largest endemic center of schistosomiasis in Japan. Approximately 500 individuals were examined in Kofu City, and each of five rural villages—Kissawa, Otsuka, Hikawa, Futakawa and Sancho. The prefecture is composed of a large valley, completely surrounded by mountains of rugged terrain; and population centers are chiefly limited to the main valley and lesser ones which radiate into the mountains. The rural villages which were surveyed included those of both hill and valley terrains, and one or more were typical of each of the three predominant agricultural areas: vineyard, mulberry and paddy. One or more parasites were found in 99.5% of the 3055 individuals examined; 99.5% of the total harbored helminths and 65.3% were infected with protozoa. The most prevalent helminth was whipworm, with an incidence of 91.6%. Other helminth infection rates included: ascaris, 88.8; hookworm, 71.8; *Trichostrongylus* sp., 44.4; *S. japonicum,* 32.0; and pinworm (by Scotch tape recovery), 36.9%.

The incidence of *E. histolytica* was 10.3%. The highest rate, 15.8%, was found at Kissawa, and the lowest, 3.7%, at Futakawa. Other protozoan rates were: *E. coli* 42.9, *E. nana* 22.0 and *G. lamblia* 5.0%.

S. japonicum was most prevalent at Futakawa and Sancho, 64.6 and 65.9% respectively; low rates characterized Kofu City and Hikawa, 3.4 and 0.2%, and in Kissawa and Otsuka they were approximately the average for the survey.

101. *Incidence of* Dirofilaria immitis, *the Dog Heart Worm, in Dogs from Mississippi.* James W. Ward and Robert C. Reeder, University of Mississippi.

The blood or the hearts of thirty one apparently normal adult dogs were examined for the presence of *Dirofilaria immitis.* Examinations were made in one of three ways: 1. Examination of thick smear of fresh peripheral venous blood from each dog; 2. Examination of one half of serum from 3cc of clotted blood from each dog; 3. Direct examination of the heart of each dog.

The results may be tabulated as follows:

	Hearts	*Peripherial Blood*	*Serum*
No. examined	10	3	18
No. positive	5	1	1
No. negative	5	2	17
Percentage positive	50	33.3	5.56

Total Number of Animals Examined, 31.
Total Number of Animals Positive, 7.
Percentage of all Animals Positive, 22.5.
The maximum number of adult worms collected from one animal was 38; the minimum number was two. Microfilariae in serum survived for nine days at 12° C.

102. *Quantitative Studies on Nematode Parasites of Horses and Mules.* JAMES W. WARD, University of Mississippi.

Results of this study are based upon the actual worm counts of nematode parasites collected from 24 animals at autopsy and from results obtained from fecal examinations of 65 additional animals. *Trichonema* spp. was found to parasitize 14 of the 24 animals examined at autopsy, while *Strongylus equinus, S. edentatus, Triodontophorus serratus* and *Gongylonema* spp. parasitized six of the 24 animals. *Triodontophorus minor, Cylicocyclus nassatus, Oxyuris equi, Setaria equini,* and *Habronema* spp. were found to parasitize two of the 24 animals examined.

Actual count of nematodes showed the cycliostomes to be the prevailing parasite in animals ten to twelve years of age. The maximum number of individuals of this group collected from one animal was 9589, while the minimum number was 145. Older animals were less heavily parasitized with this group of nematodes. Animals in the three month old group showed 380 individual worms of this group, or less. Animals in the two year old group showed the highest infestation of large strongyles. Individual counts showed an average of over 700 of these parasites per animal, while the average number in the six and nine month old group was 100 to 150 per animal. Animals 20 years and older showed an infestation of cycliostomes ranging from 1106 to 5249 specimens per animal.

These results closely coincide with those obtained from fecal examinations of the 65 animals, except in the case of Strongyloides. The number of eggs of this parasite were more in proportion to the number of adult worms.

103. *The Prophylactic and Suppressive Antimalarial Effect of Metachloridine with* Plasmodium cathemerium *in the Canary.* WENDELL D. GINGRICH, University of Texas.

Metachloridine is the most effective prophylactic against *Plasmodium cathemerium.* On a five-day schedule of treatment it completely prevented infection only with high doses (0.5 to 1 gram/K). With ten days treatment, the same effect was observed with as little as 1 mg/K per day. Suppressively the drug was effective in that it has a high quinine equivalent (33) but even with maximum tolerated doses blood examinations frequently revealed scant positives. With both short-term and long-term curative tests, the drug was invariably ineffective.

104. *The Incidence of Trichinosis in Alabama as Indicated by the Examination of the Diaphragm and Three Other Muscles from 300 Autopsies.* J. HENRY WALKER, University of Alabama.

Examinations of the diaphragm, intercostal, rectus abdominis, and pectoral muscles from 300 unselected autopsies shows 109 positive cases, or an incidence of 36.3 per cent.

Both microscopic-compression and digestion methods were used in the examination of material. For individual muscles processed by the latter method, muscle digestion, sedimentation of larvae, rinsing of debris, and the search for larvae were made in one container with a separable bottom.

In the 109 positive cases, the following numbers of positive muscles were found: 86 diaphragms, 63 intercostals, 64 recti abdomines, 62 pectorales. In 33 positive cases, the digestion method showed all four muscles positive with trichinella larvae; in 12 positive cases, the compression method showed all four muscles positive with trichinella larvae. It appears that in those cases which contain more than 1 larva per 10 grams of diaphragm as determined by the digestion method, other muscles as well will be found infected.

An examination of the diaphragm alone would have shown 86 positives and would have missed 23 positives. Apparently those incidences based upon an examination of the diaphragm alone by one method, or a combination of the two methods, are too low.

Most of the 300 cases examined were from an urban population of low economic status. The results indicate that most of the positives were light infections.

Aided by a grant from the Faculty Research Committee, University of Alabama.

105. *Observations on the Life History of* Allocreadium ictaluri *Pearse.* PHILIP G. SEITNER, Purdue University.

Metacercariae which occur in Unionidae in the Tippicanoe and Wabash Rivers, Indiana, have been demonstrated by feeding experiments to develop in the catfish. The adult worm proved to be *Allocreadium ictaluri* Pearse, which species was subsequently found naturally infecting *Ictalurus punctatus.* In the Wabash River an undescribed species of cercaria was finally discovered which was experimentally proven to encyst in mussels and to develop to metacercariae indistinguishable from metacercariae of natural infections.

The cercariae, ophthalmocercariae with simple tails, develop in rediae in the digestive gland of Pleurocera. The incidence of infection of snails is approximately 0.5% in late summer, less during the winter and spring. The fully contracted cercariae measure 0.14 mm in length, 0.12 mm in width; the body may extend to 0.25 mm in length by 0.09 mm in width. The tail, contracted, is 0.10 mm long; extended, 0.27 mm long. The oral sucker is 0.040 mm in diameter; the ventral sucker, 0.047 mm in diameter. The simple excretory vesicle, filled with refractile granules, is deflected to one side. The body and tail are devoid of setae, although the anterior tip of the body appears minutely denticulate. The vacuolar nature of the body cells prevented complete determination of the excretory pattern.

Upon emergence the cercariae respond positively to light, becoming negatively responsive after a short time. They passively enter the mantle chamber of mussels through the incurrent siphon and penetrate the edges of the mantle where they remain till the death of the bivalve when they are ingested by catfish.

106. *Methylene Blue Precipitated with Cadmium Chloride as a Restaining Agent for Blood and Tissue Protozoa.* ERNEST HARTMAN, Chicago Medical School.

The well known tendency of Romanowsky type stains to fade results in the deterioration of many excellent preparations. The blues are particularly unsatisfactory both from the standpoint of permanence and of restaining.

A useful restaining blue can be secured by slowly adding a methylene blue solution (1 gm in 40 ml distilled water) to 20 ml of 25% cadmium chloride. The resulting precipitate is collected on filter paper and dried. The weight of the recovered stain is in excess of 2.5 times the methylene blue used. One gram of the precipitated stain is dissolved in 500 ml of N/30 phosphate buffer of pH 7.4. This stock blue solution keeps indefinitely and can be used full strength, diluted, or combined with aqueous eosin. When combined with eosin a useful proportion is 1–1.5 ml 1% eosin per 30 ml blue solution.

Old slides should be thoroughly cleaned of all oily and resinous materials. For cleaning, xylol followed by benzene is recommended. The staining time varies with different specimens. When the film shows a slightly blue color upon holding it up to the light, the slide should be rinsed in tap water and dried.

Old, faded slides of *Leishmania* (culture and tissue), *Toxoplasma, Trypanosoma, Leucocytozoon,* and *Plasmodia* have been satisfactorily restained by this method.

107. *Blood Parasites of Birds from Kern County, California.* CARLTON M. HERMAN, California Division of Fish and Game; WILLIAM C. REEVES, Hooper Foundation, University of California; AND H. ELLIOT MCCLURE, Communicable Disease Center, U. S. Public Health Service, Berkeley, California.

During the summers of 1946 and 1947, in conjunction with investigations on encephalitis in the Bakersfield Area, a study was made on the occurrence of blood parasites in the wild birds of the region. The ultimate goal of this phase of the undertaking was to determine relationships that might exist between incidence and vectors that could be correlated with current findings from the field studies of other phases of encephalitis investigations.

A total of over 6,000 blood smears were obtained from wild birds during the two year study, chiefly from areas close to Bakersfield. The areas studied included a park area on Kern River, a large olive grove north of Bakersfield, and a rural farm area about fifteen to twenty miles northwest of Bakersfield. Blood smears were obtained from trapped adult and juvenile birds and from nestlings.

The genera of parasites found included *Plasmodium, Haemoproteus, Leucocytozoon,* an intraleucocytic form, *Trypanosoma,* and the microfilaria stages of filariid worms. Incidence varied considerably among different species of hosts, age groups of a single host, and type of locality

in which the birds were captured. In some cases incidence varied considerably in one species of host during the two years, particularly with infections of microfilaria, but for the most part infection rates were approximately similar each year.

This investigation was carried out in collaboration with the Commission on Virus and Rickettsial diseases, Army Epidemiological Board, Office of the Surgeon General, U. S. Army; under contract with the Research Grants Division, U. S. Public Health Service; and aided by a grant from the National Foundation for Infantile Paralysis.

108. *The Protozoan Fauna of Some Species of Intertidal Invertebrates in Southern California.* HENRY I. HIRSHFIELD, University of Missouri.

These studies are the results of a partial survey of the protozoan faunas of ten host species of intertidal marine gastropods in Southern California. The ten gastropod hosts are: *Acmaea pelta, A. digitalis, A. limatula, A. scabra, A. insessa, A. fenestrata fenestrata, Lottia gigantea, Fissurella volcano, Tegula funebralis* and *T. ligulata.*

Interest was primarily focused upon the ciliate population when it was found that it comprised the consistent bulk of the parasite populations within the hosts. Of the six ciliate species encountered within these hosts, three new species are proposed: *Urceolaria karyolobia, Trichodina tegula,* and *Scyphidia ubiquita.* Three other species previously described from other hosts are reported for the first time from Southern California gastropods: *Urceolaria korschelti* Zick, *Lincnophora conklini* Stevens, and *Eupoterion pernix* MacLennan and Connell.

The incidence, location and effect of the parasites upon the hosts was studied. The primary parasite faunules of the limpets and turbans surveyed belong to the ciliate order Peritricha. *Scyphidia ubiquita* was found to occur naturally in all ten host species. *Urceolaria* spp. and *Eupoterion* were limited to members of the Acmaeidae, *Trichodina* to turban hosts. *Licnophora* occurred primarily in *Fissurella,* but were also found in *Acmaea insessa* and *Tegula funebralis.*

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1928	New York	1936	Atlantic City	1943	(No meeting)
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CROWCROFT, PETER, B.S., M.S. Zoology Department, University of Tasmania. Tasmania, Australia.

CUNLIFFE, FREDERICK, B.S., M.S. Dryden Biological Laboratory, Dryden, Maine.

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DOLLFUS, ROBERT, Ph., Dr.Sc. Lab. d'Helminthologie coloniale et de Parasitologie Comparée, Museum National d'Histoire Naturelle, 57 Rue Cuvier, Paris Vème, France.

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GRIFFITHS, HENRY J., B.S.A., M.S., Ph.D. School of Veterinary Medicine, University Farm, St. Paul 1, Minnesota.

GUILFORD, HARRY G., Ph.B., Ph.M. 2124 Commonwealth Avenue, Madison 5, Wisconsin.

HARRINGTON, ROBERT F., B.S. 908 U.S. Custom House, Chicago, Illinois.

HIRSHFIELD, HENRY I., A.B., M.A. Zoology Department, University of Missouri, Columbia, Missouri.

HYLAND, KERWIN E., JR., B.S. Department of Tropical Medicine and Public Health, 1430 Tulane Avenue, New Orleans 13, Louisiana.

KENT, DONALD E., A.B. 404 Pittsboro Street, Chapel Hill, North Carolina.

LAWRENCE, REGINALD F., M.A., Ph.D. Natal Museum, Pietermaritzburg, South Africa.

LAIRD, MARSHALL, B.S., M.S. Department of Zoology, Victoria University College, Wellington, New Zealand.

LEE, CHARLES B., B.S. 1009 E. Catherine Street, Ann Arbor, Michigan.

LISKA, BERYL, B.S. 907 Park Place, Wilmington, Delaware.

MACDONALD, ETTA MAE, B.S., B.A., M.S., Ph.D. Department of Preventive Medicine and Public Health, University of Texas Medical Branch, Galveston, Texas.

NORRIS, GAIL R., B.S., M.S. 767 Melrose Avenue, Columbus 11, Ohio.

ODLAUG, THERON, O., A.B., M.S., Ph.D. Department of Zoology, University of Minnesota, Duluth Branch, Duluth 5, Minnesota.

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SILLMAN, EMMANUEL I., B.S. Room 414 Victor C. Vaughan House, University of Michigan, Ann Arbor, Michigan.

SIMONS, HELLMUTH C. R., Ph.D. 205 N. 36th Street, Philadelphia 4, Pennsylvania.

SMITH, CHARLES F., A.B. 1301 West Campus, Lawrence, Kansas.

SOROKER, ROBERT H., B.S. 1501 Lincoln Way, San Francisco 22, California.

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[1] To October 1, 1948. The last preceding list of members was published in the Journal of Parasitology, 1947, *33* Supplement: 35. Earlier lists appeared in the Journal of Parasitology in 1926, *12*: 170; in 1934, *20*: 345; and in 1942, *28* Supplement: 41.

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STUBBS, HENRY L., A.B., M.S. Opelousas, Louisiana.

SUESSENGUTH, HAZEL, B.S. Mt. Sinai Hospital, Main Laboratory, 1800 E. 105th Street, Cleveland 6, Ohio.

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ULMER, MARTIN J., B.S., M.S. Room 1111, Nat. Science Building, Department of Zoology, University of Michigan, Ann Arbor, Michigan.

VEGORS, HALSEY H., B.A. U.S. Bureau of Animal Industry, Regional Animal Disease Research Laboratory, P.O. Drawer 952, Auburn, Alabama.

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WELSH, HARTWELL H., B.S., M.S. California State Department of Public Health, Bureau of Vector Control, 2180 Milvia Street, Berkeley 4, California.

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